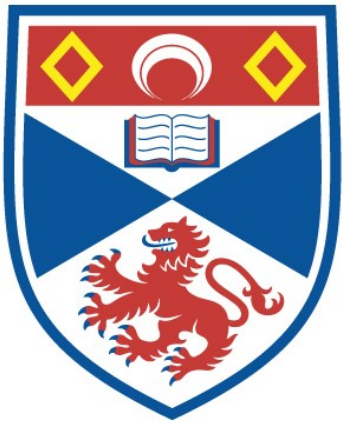
THE VALUE OF OUTDOOR RECREATION WITH SPECIAL APPLICATION TO LOCH LEVEN

John David Sloan

A Thesis Submitted for the Degree of MPhil
at the
University of St Andrews



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On page 82 there is a Table in which "£" signs have been inserted. These "£" signs should not be there since the Table is one of number of outings and not costs.

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ABSTRACT

Loch Leven an angling resource in the Fife Region of Scotland approximately twenty-eight miles north of Edinburgh. For many years, it provided anglers with outstanding challenge and pleasure. However, many anglers are now becoming disheartened by the fact that the quality of angling at Loch Leven has deteriorated substantially over the past ten to fifteen years. Some vow that they will not return unless something is done to improve the resource.

The following is a cost-benefit study. The costs to be measured are those which must be incurred in order to improve the quality of angling at Loch Leven. These include the cost of reducing the pike population in the loch and the costs involved in the construction and maintenance of a fish hatchery so that Loch Leven may be artifically stocked with its unique trout. The benefits accrued, not only to anglers but to the community of Kinross, will be calculated using various techniques, some of which may be considered inadequate or illogical.

The most promising technique for imputing a monetary value to primary or user benefits was developed by Marion Clawson. The major portion of the discussion of primary benefits is devoted to his model. In order to apply the Clawson technique to Loch Leven, a survey of anglers was undertaken and the details of this survey are presented. The responses of the 114 anglers who returned the questionaire form the basis for the primary benefit calculations.

Secondary benefits, or the benefits accrued to the surrounding community of Kinross, are measured using an income multiplier model

developed by the Tourism and Recreation Research Unit of the University of Edinburgh. Again the angler surveys form the basis for these calculations. The Present Value of costs and benefits is calculated and a benefit-cost ratio presented. Because this ratio exceeds unity, it is recommended that measures be undertaken to improve the quality of angling at Loch Leven so that one of Scotland's most famous recreation resources may once again be the envy of the world's angling community.

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"I declare that this thesis has been composed by myself and that the work of which it is a record has been done by myself. I also declare that this thesis has not been accepted in any previous application for a higher degree in the University of St. Andrews or elsewhere.

I was enrolled in October 1978 as a candidate for the degree of M.Phil."

"I declare, as supervisor, that the conditions of the Resolution and Regulations have been fulfilled."

Acknowledgments

With a study such as the one that follows, the advice and assistance of many people is essential. To the following people, I am extremely grateful.

Mr. Stuart McDowall who supervised the writing of this work with interest and enthusiasm.

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The 114 anglers who returned completed questionnaires.

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Introduction

Scotland has always been renowned for its abundance of outdoor recreation facilities. The golf links at St. Andrews, the rugged beauty of the Highlands and Islands and the innumerable lochs, rivers and streams are well known throughout the world and have provided sportsmen with unmatched challenge and pleasure. One of Scotland's most famous resources is Loch Leven, an angling resource some twenty-eight miles north of Edinburgh. Loch Leven Trout are well known for the challenge they present to the angler and for their unique flavour once caught. However, according to some scientists and anglers, Loch Leven is not the resource that it was twenty or thirty years ago.

Prest and Turvey define cost-benefit analysis as "a way of setting out the factors which need to be taken into account in making certain economic decisions".[1] In order to improve the quality of angling at Loch Leven, an economic decision must be made. There are two questions which must be answered before a cost-benefit study of Loch Leven is undertaken:

1) Which costs and benefits are to be included?

2) How are they to be valued?

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1 - A.R. Prest and R. Turvey. "The Main Questions". *Cost Benefit Analysis*. Harmondsworth, 1976. p. 73.

The first question may be answered once the problem is defined. This is done in Chapter II where possible solutions are also presented. The costs of these solutions are calculated for comparison with benefit calculations.

Chapter I outlines some of the methods used to calculate primary or user benefits. Many of these are considered to be inadequate for reasons that will be made clear as each technique is discussed. Other methods are considered to be more promising and therefore are given more attention. In Chapter III, these methods are applied to the case of Loch Leven in order to calculate the amount of primary or user benefits accrued from the use of Loch Leven.

The anglers who fish at Loch Leven are not the only beneficiaries. Secondary benefits must be defined and calculated as well. Prest and Turvey give an example of the secondary benefits accrued as the result of an irrigation project. "Direct or primary benefits are measured as the value of the increase in grain... The increased grain output will involve increased activity by grain merchants, transport concerns, millers, bakers and so on, and hence, it is asserted, will involve an increase in their profits."[1] These then, are the secondary benefits. Just as millers and bakers benefit from an irrigation project, shopkeepers and other businessmen in the Kinross area benefit from the sustained

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1 - Prest and Turvey. *op. cit.* p. 78.

use of Loch Leven as an angling resource. Anglers bring with them money to spend and this spending will result in an increase in profits.

The purpose of this study may now be clearly defined. Methods used to value primary and secondary benefits will be discussed and applied to the case of Loch Leven. These benefits will be compared to the cost of maintaining Loch Leven as an outstanding angling resource. A benefit/cost ratio will then be calculated and if this ratio exceeds unity, it will be recommended that steps toward the improvement of Loch Leven be taken.

CHAPTER I

METHODS USED TO CALCULATE PRIMARY BENEFITS

1. Inadequate Techniques

Numerous methods have been employed or suggested for imputing the monetary value of outdoor recreation. The following techniques are considered by this author to be analytically inadequate for reasons which will be made clear as each approach is discussed below.

The Opportunity Cost of Time Approach

It has been argued that the value of a day spent in recreation can be calculated using the Gross National Product. Leisure is considered as a factor of production that is complementary to work and therefore its value is equal to GNP divided by the total population multiplied by the number of days in the year. The value of recreation to a recreationist is assumed to be at least equal to the wage he has foregone in pursuit of it.

Very often this assumed "choice" between work and leisure is not available to the recreationist since non-priced recreation is most often used during annual vacations and on weekends. Also, a large number of recreationists (mainly the young and the retired) are not members of the

labour force. As Brown et al. point out, "it is clear that the problem is assumed away when this procedure is followed."[1]

The Opportunity Cost of the Resource Approach

Following the opportunity cost of the resource approach, the value of a recreation resource is considered to be at least equal to the value of annual output which that resource could have earned in its highest alternative use. This value, when divided by the number of recreation user-days per year, yields a shadow price for recreation.

Perhaps the best way to illustrate the inadequacy of this technique is to present an example. There is a stretch of land near the town of St. Andrews which runs from the end of the Eden Golf Course, along the Eden Estuary to the town of Guardbridge. Because of the nature of its sandy soil, the agricultural value of this land is very small. In fact, most of the land is now being used as pasture for sheep. However, a golf course of a quality comparable to that of existing courses in St. Andrews could probably be developed here. The value of this land as a recreation resource would almost certainly exceed its value as farmland. On the other hand, the land's value as a location for housing developments

1 - W.G. Brown, A. Singh and E.N. Castle. "Net Economic Value of the Oregon Salmon-Steelhead Sport Fishery". *Journal of Wildlife Management*. XXIX, 2. April 1965. p. 268.

is probably very high--higher than its value as a recreation resource.

The opportunity cost of the resource approach is therefore inadequate because some of the finest recreation areas have little or no value in an alternative use. On the other hand, some of the poorer areas might be very valuable in other uses.

The Cost Approach

Another inadequate and illogical approach to measuring the value of a recreation resource is the cost approach. This technique was used by the U.S. National Park Service from 1950 to 1957. It was contended as follows: "....A reasonable estimate of the benefits arising from a reservoir itself may normally be considered as an amount equal to the specific costs of developing, operating and maintaining the recommended facilities...."[1] Brown et al. comment on this approach as well. They call it a "good example of circular reasoning".[2]

To assume benefits equal to costs in every instance is to make every project self-justifying and no basis would exist for the establishment of priorities among projects. The reason for estimating benefits in the first place is to aid in the decision of whether or not to create new

1 - Brown *et al., op. cit.* p. 267.
2 - *Ibid.*

facilities or improve existing ones, and with the cost approach, every investment would be considered worthwhile.

The Fixed Value Approach

The fixed value approach is a commonly used approach which involves the placing of a uniform monetary value on all visits to all recreation sites. This unit value, when multiplied by the number of visitors to an area, establishes the total recreation value of the area. The U.S. National Park Service, in 1962, valued all water-oriented resources at $1.60 per person per day. This figure was obtained by averaging the values of a recreation day on all private sites for all types of recreation usage.

It is impossible to place one value on all sites. Many important factors will affect differences in quality and hence differences in value. A good fishing resource, that is, one where the fish are large and plentiful, will be worth more to the user than a poor one. Other factors such as location and beauty of the resource are ignored in the fixed value approach. Assigning one value to all recreation resources is like assigning one wage to all workers. It is not reasonable.

The Market Value Approach

The market value approach involves inputing to a

hunting or fishing resource recreation benefits equal to the net harvest multiplied by the equivalent market value per unit of commercially caught fish or game. The most serious objection here is to the implication that the fish or game, rather than the hunting or fishing, is the primary object of the activity.

Most sportsmen regard the physical rewards of hunting or fishing as only a small part of the benefits to be derived from the use of an area. Also, the cost of the hunting or fishing is usually several times the market value of the catch. This indicates that the sportsmen use an inefficient method of acquiring meat or fish. Finally, many species of sport animal are not sold commercially, so no market value exists for them.

The Expenditure Approach

It has been argued that the value of a recreation area is equal to the annual expenditure made by people pursuing the recreation. Expenditures for travel, lodging, food, sporting equipment and tolls, if any, are included. The assumption is that the money spent is an appropriate measurement of the benefits received and that recreation is valued at least as highly as other goods that could have been purchased with the same funds.

The most obvious problem with this approach is in

deciding what amounts would not have been spent by the recreationist had he not used the resource. Food expenses, some travel expenses and clothing expenses would almost certainly have been incurred regardless of where the recreationist was or what he was doing. How much more did he spend as a result of his pursuit of recreation? This is difficult to determine.

D.A. Benson in his study entitled Hunting and Fishing in Canada[1] compiled some rather impressive statistics, such as that Canadians travelled over one billion man-miles in private vehicles to fish and hunt during 1961. He calculated that sport fishermen spent $187,651,082 and that hunters spent $87,345,935 in pursuit of fish and game. Benson points out that "the most commonly used measure of the value of sport fishing and hunting is the amount spent by the participants. It can be estimated statistically and can be expressed in dollars."[2] This total of $274,997,015 therefore represents the value of sport fishing and hunting in Canada in 1961. However, spending does not measure the benefits that an individual derives from recreation. It measures only the cost of complementary goods that the recreation finds necessary to enjoy the recreation.

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1 - D.A. Benson. *Hunting and Fishing in Canada--1961.* Department of Northern Affairs and Natural Resources. Ottawa, Canada. 1963.
2 - *Ibid.* p. 11.

As Trice and Wood[1] point out, such data may be used as a measure of the benefits accrued to supporting industries; that is, they may be used in the calculation of secondary benefits. This point will be discussed further in Chapter IV. Gross expenditure data, while an inaccurate measure of the value of a resource to a recreationist, is worth compiling since it does give some idea of the magnitude of the recreation industry.

The Substitution Approach

The final inadequate technique to be discussed in this section is one that involves comparing the costs of other existing private facilities to the facility being examined. This approach has not gained wide acceptance, although studies using it do exist. One such study was carried out at the University of California at Los Angeles (UCLA). It gives an excellent illustration of how the substitution approach is applied and it also allows its weaknesses to be made clear. A summary of the UCLA "Evaluation of Rooftops as Park Sites" will now be presented.[2]

The idea of using rooftops as sites for parks and recreation was first suggested by Marion Clawson who argued:

1 - A.H. Trice and S. Wood. "Measurement of Recreation Benefits." *Land Economics*. Vol. II. 1966. p. 200.

2 - J.M. Kavanagh, M.J. Marcus and R.M. Gay. "An Evaluation of Rooftops as Park Sites." *Program Budgeting for Urban Recreation*. New York. 1973.

> "If one views a city from an elevation of no more than 300 feet (for instance, from a low-flying helicopter or from a very tall building), the city is seen to have a great deal of open space--approximately as much as the site had before the city was built. A sea of rooftops may not be an exhilarating view, and ventilators, elevator housings and other protuberances may interfere with many possible uses of such open space, although some uses, like sunbathing, do indeed take place. In looking to the more distant future, the urban rooftop may be the unexplored frontier: its use on a large scale, as an open space will present many problems, just as the use of any frontier, but its areal extent and its location demand serious consideration."[1]

The researchers at UCLA set out to discover whether the idea of rooftop recreation sites was an economically sound one. This they did using an illustrative cost-benefit analysis.

The site chosen was a rooftop area of about 20,000 square feet in West Los Angeles--a neighbourhood with higher than average income, a representative age distribution of residents and a relatively smog-free atmosphere. The facilities in the park were to include a fully enclosed basketball/volleyball/tennis court; two handball courts, two shuffleboard courts and a covered dining/rest area. A diagram of the proposed layout may be found on the following page. It was assumed that the park was to have lighting allowing it to be open for twelve hours a day (from 10 AM until 10 PM).

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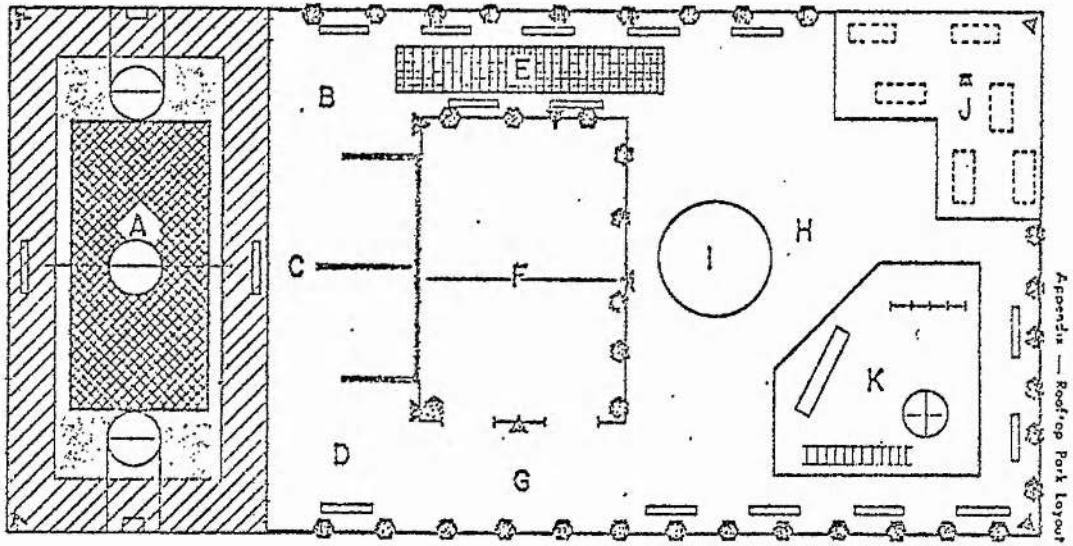
1 - Kavanagh *et al. op. cit.* p. 73.



Appendix — Rooftop Park Layout

Symbols:
- Bench
- Table
- Light
- Planter
- Swings
- Slide
- Swing bars
- Merry-go-round

ROOF-TOP PARK

SCALE - 1" = 20'

A. Game area (enclosed with netting)		5,000
B. Open area		900
C. Handball courts		1,200
D. Open area		775
E. Shuffleboard court		900
F. Elevator mechanisms power unit & rest rooms		2,300
G. Open area		775
H. Multipurpose area incl.:		8,150
I. Sand box	315	
J. Covered dining	1,200	
K. Padded play	1,400	
		20,000

Cost estimates were then calculated. Since this paper is primarily concerned with the calculation of recreation benefits, the costs will simply be listed and their present value calculated using the formula

$$PV = \sum_{t=1}^{n} \frac{a_t}{(1 + r)^t}$$

where n the expected life of the project (in years)

a the annual value of the cost (or benefit)

t time

r the discount rate

ROOFTOP PARK COST ESTIMATES[1]

Item	Cost
Equipment	
Purchase and installation	$ 40,975
Maintenance	3,000/year
Building Costs	
Elevator capacity	
Purchase and installation	50,000
Maintenance	4,000/year
Structural Strength etc.	200,000
Supervision	
Security officer	9,350/year
Parents	2,565/year
Injuries and property damage	
Injuries to users	1,000/year
Property damage and Injuries to non-users	1,500/year

In discounting, a value of forty years was assumed

1 - *Ibid.* p. 89.

for n due to the difficulties involved with projecting costs and benefits any further in the future. Actual project life was estimated to be 100 to 150 years. Three discount rates were presented for purposes of comparison and the present value of costs are given below.

	Discount Rate[1]		
	4%	6%	10%
PV of Costs	$714,992	$612,200	$500,414

It was contended that the most appropriate rate of discount was 10% since this rate allows for discounting of future returns and costs that are unadjusted to account for uncertainty.

"Deriving a method for estimating direct recreation benefits represented the major conceptual problem of this study."[2] Because of the impossibility of establishing distance zones around an urban recreation site[3] it was decided that a method using "the price of substitute private sector recreation services as a proxy for the price public park users would be willing to pay to use the park"[4] should be employed. A list of the private sector recreation services that were used in this study follows.[5]

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1 - *Ibid.* p. 91.
2 - *Ibid.*
3 - For a detailed description of the concept of distance zones, please see Part 2 of this chapter.
4 - Kavanagh *et al. op. cit.* p. 92.
5 - *Ibid.* p. 93.

COSTS OF PRIVATE RECREATION PROVIDED FOR ADULTS
IN WEST LOS ANGELES

Form of Recreation	Cost per Use	Hours per Use	Cost per H
Swimming	$ .50	1	$ .50
Ice Skating	2.00	2	1.00
Bowling	.45	1/3	1.35
Pool	-	-	.50
Golf	4.00	4	1.00
Miniature Golf	1.00	3/4	1.33

An unweighted average cost per hour for this list is $ .95. Since many age groups can participate in recreation at reduced rates, estimates of the value for each group were calculated. For adults between the ages of 18 and 60, the $ .95 per hour estimate was used. Children under 12 were given a value of $ .314 per hour, 12 to 18 year olds, $ .712 per hour, and for those over 60, a value of $ .475 was assigned.

The next step was to establish the percentage of total user-hours for each age group. The results were as follows.

Under 12	30%
12-18	22
18-60	18
Over 60	30
	100%

It was estimated that the park would be used 350 days during the year with twenty users per hour during June, July and August and fifteen users per hour for the remaining months--a total of 68,400 user hours per year. Given all these figures, the annual value of the rooftop was calculated.

ANNUAL BENEFITS OF PROPOSED ROOFTOP PARK[1]

Age Group	Percentage Use	User-Hours/year	Value/hour	Value
Under 12	30	20,520	$ .314	$ 6,443
12-18	22	15,048	.712	10.714
18-60	18	12,312	.950	11,696
Over 60	30	20,520	.475	9,747
	100	68,400		$38,600

The figure of $38,600 per year was discounted at the three rates--4%, 6%, and 10%--and the results as well as the cost results obtained earlier follow.

PRESENT VALUE OF RECREATION BENEFITS

	Discount Rate		
	4%	6%	
Benefits	$764,280	$579,000	$377,508
Costs	714,992	612,200	500,414
Net Present Value	49,288	(33,200)	(122,906)

Clearly, at the recommended discount rate of 10%, the project is not economically viable. This however, is not our concern. We are concerned here with the technique used to arrive at the result.

One obvious problem with this substitution or proxy approach is that no allowance is made for tastes and preferences. A recreationist may feel that he is getting better value from the $ .95 per hour spent on a rooftop park than he could get from swimming at $ .50 per hour. The value

1 - *Ibid.* p. 94.
2 - *Ibid.* p. 95.

of the rooftop park would therefore be underestimated. The reverse may also be true. A golfer may be getting better value for his $1.00 per hour than the shuffleboard player is getting for his $ .95. The rooftop park is then overvalued.

Another drawback to this particular study is that no cost-free activity is included in the list of "representative" recreation activities. If only one such pastime (a walk in a park for example) was listed, the new unweighted average benefit per hour would be $ .81. This would lower the estimated value of the rooftop park.

Finally, because the list of alternative activities is not complete and not weighted according to user-hours per activity, the proxy value is again distorted. To use an extreme example, rental of a helicopter for one hour may cost, say $300. In the entire city of Los Angeles this might be done only twice in a day, but such an activity could be included on the list. This would increase the unweighted average to $43.56 per hour and the value of the rooftop park would be overestimated.

The substitution of proxy technique may only be applied accurately if all possible activities are listed and weighted according to user-hours. Even if this was possible, the list would have to be constantly revised to allow for changes in facilities, income and tastes and preferences. Over a period of forty years, these parameters

would change an infinite number of times. This technique while possibly the only method of evaluating urban recreation facilities, is neither an accurate nor a practical means of calculating user benefits.

2. The Indirect Approach--Techniques Using Consumers' Surplus

Marshall defined consumers' surplus in the following way.

> "....the price which a person pays for a thing can never exceed, and seldom comes up to that which he would be willing to pay rather than go without it: so that the satisfaction which he gets from its purchase generally exceeds that which he gives up in paying away its price; and he thus derives from the purchase a surplus of satisfaction. The excess of the price which he would be willing to pay rather than go without the thing, over that which he actually does pay, is the measure of surplus satisfaction. It may be called consumers' surplus."[1]

The following section will include a discussion of several techniques used to evaluate recreation benefits that are based on the concept of consumers' surplus. These techniques have gained wide acceptance and are generally regarded as the most logical for measuring the value of recreation resources to users.

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1 - Alfred Marshall. *Principles of Economics*. London, 1907. p. 25

The Pearse Approach

In 1968, Peter J. Pearse presented a new approach to the evaluation of non-priced recreation resources.[1] In his paper, he introduced the concept of the marginal user from within each of six income groups. "The visitor with the highest travel cost in an income class is assumed to break even, in the sense that he enjoys no consumers' surplus."[2] The cost to this "marginal recreationist" is represented by TmY. Each intramarginal recreationist (x) will incur costs of TxY and Pearse argued that the population that would continue to participate under a certain toll P consists of all those for whom TxY + P = TmY. The maximum toll that each visitor would be willing to pay is equal to TmY - TxY and the total of these differences for visitors in all income classes represents the value of the resource in terms of the consumers' surplus it generates to visitors under free access.

Pearse calculated the value of big game hunting resources in the East Kootenay district of British Columbia using this approach. From a 3.4% sample of the 14,000 big game hunters who hunted the area in 1964, he established six income classes. The fixed cost of each hunter was identified as the declared cash cost of travel to and from

1 - Peter H. Pearse. "A New Approach to the Evaluation of Non-Priced Recreational Resources." *Land Economics*. XLIV, 1. Feb. 1968.
2 - *Ibid*. p. 91.

the area, an allowance for the value of time spent in travel[1] and other necessary expenses that were incurred. The following table was presented.[2]

CALCULATION OF CONSUMER SURPLUS FOR RESIDENT BIG GAME HUNTERS IN THE EAST KOOTENAY IN 1964.

Income Group	Number of Observations	Highest Fixed Cost	Average Consumer Surplus
- $2000	25	$ 66	$ 47
$2000-4000	67	183	149
$4000-6000	219	287	224
$6000-8000	109	320	221
$8000-10000	32	267	152
+ $10000	33	355	196
Total Sample	485		(weighted) $197

This amount of $197, when multiplied by the number of hunters (14,722) yielded a value of $2,900,242 for the East Kootenay hunting resource in 1964.

The Hotelling Approach

Professor Harold Hotelling of the University of North Carolina was the first to suggest defining concentric distance zones around a recreation site, where travel costs from within each zone were assumed to be approximately constant. In a letter, sent in 1947 to the Director of the United States National Park Service, Hotelling outlined his

1 - A discussion of Pearse's approach to measuring the cost of time appears later in this chapter.
2 - Pearse *op. cit.* p. 96.

approach in the following way.[1]

> "Let concentric distance zones be defined around each park so that travel to the park from all points in one of these zones is approximately constant. The persons entering the park in a year, or a suitable chosen sample of them, are to be listed according to the zone from which they came. The fact that they came means that the service of the park is at least worth the cost, and this cost can be estimated with fair accuracy. If we assume that the benefits are the same no matter what the distance, we have, for those living near the park, a consumer's surplus consisting of the differences in transportation costs. The comparison of the cost of coming from a zone with the number of people who do come from it, together with a count of the population of the zone, enables us to plot one point for each zone on a demand curve for the service of the park. By a judicious process of fitting, it should be possible to get a good approximation of this demand curve to provide, through integration, a measure of the consumers' surplus resulting from the availability of the park. It is this consumers' surplus (calculated by the above process with deduction for the cost of operating the park) which measures the benefits to the public in a particular year. This, of course, might be capitalized to give a capital value for the park, or the annual measure of benefit might be computed directly with the estimated annual benefits on the hypothesis that the park area was used for some alternative purpose.
>
> The problem of relations between different parks can be treated along the same lines, though in a slightly more complicated manner, provided people entering the park will be asked which other national parks they have visited that year. In place of a demand curve, we have as a result of such an enquiry, a set of demand functions. The consumers' surplus still has a definite meaning, as I have shown in various published articles, and may be used to evaluate the benefits from the park system.

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1 - Source: W.G. Brown, A. Singh and E.N. Castle. *An Economic Evaluation of the Oregon Salmon and Steelhead Sport Fishery.* Corvallis, Oregon. 1964. pp. 6 and 7.

> This approach through travel costs is one of several modes of attack on this problem. There are also others, which should be examined though I think the method outlined above looks most promising."

The Trice and Wood Approach

In 1958, Andrew H. Trice and Samuel E. Wood applied Professor Hotelling's approach to three similar areas of the Sierra Nevada Recreation Region to estimate the recreation value of the region.[1] They obtained data on (1) the number of persons in each recreational party, (2) the city or county of origin of each party, (3) the number of days spent by each party in the area of recreation and (4) the number of days that the party spent on its entire recreation trip. From these data, an average cost of travel per visitor per day was computed. The travelled distance was based upon actual road mileage from the county seat or center of population to the center of the recreation site. A per mile cost of 6.5 cents was assumed, although rates of 5.0, 5.5, 6.0, 7.0 and 7.5 cents per mile were also used for purposes of comparison.

Unlike Professor Hotelling who suggested that the market value of a recreation day was equal to the highest travel cost, Trice and Wood assumed it to be equal to the cost at the 90th percentile. From this bulk line (which was

1 - A.H. Trice and S.E. Wood. "Measurement of Recreation Benefits." *Land Economics*. XXXIV, 3. August 1958.

estimated to be $3.14 for the Upper Feather River area, for example) the median cost per visitor day ($1.05 in this example) was subtracted to obtain the amount of free benefits received ($2.09). This amount was aggregated and the final figure was assumed to be the amount of consumers' surplus enjoyed by the intramarginal recreationist or, the total value of the resource to users.

The table comparing the 90th percentile values, median values and free values received for the three areas is presented below. Travel cost is 6.5 cents per mile.

Area	(1) 90th percentile	(2) Median	(3)=(1)-(2) Free value received
Upper Feather River	$3.14	$1.05	$2.09
Truckee River (Donner to Verdi)	$2,93	$ .94	$1.99
Truckee River (Tahoe to Donner)	$3,15	$1.06	$2.09

Source: Trice and Wood *op. cit.* p. 206.

Professor Lawrence G. Hines criticized the Trice and Wood 'cost of travel index' as a method for measuring recreation benefits because it did not include other important demand factors. "By avoiding the consideration of the influence of income and taste, information pertinent to the design, size and location of recreational facilities may

be disregarded...The great disadvantage of the 'travel costs' index is that it achieves simplicity and measurability at the expense of significance and relevance."[1]

The effect of other factors such as those outlined by Hines will be discussed in Chapter III.

Trice and Wood have also been critized for their decision to cut off extremely high costs. Why was the 90th percentile chosen? We are not told. Despite these criticisms, it was this pioneering effort of Trice and Wood that aroused considerable interest in the improving of quantitative analysis.

The Clawson Approach

Marion Clawson is credited with reviving the Hotelling model and giving it an interpretation that further facilitates the measurement of recreation values. His approach has enjoyed wide acceptance and has influenced reserach in recreation evaluation.

Like Hotelling's, Clawson's technique involves dividing the area around the recreation site into distance zones. Homogeneity over each zone rather than of all individuals is assumed. It is also assumed that the difference in the rates of use between the zones are caused

1 - Lawrence G. Hines. "Measurement of Recreation Benefits: A Reply", *Land Economics*, XXXLV, 1958. p. 366.

by the differences in the money cost of visiting the site. Knetsch explains the Clawson method using an illustrative example.[1]

In this example, the area around the site is divided into three distance zones A, B, and C. Data on those zones are presented below.

Zone	Population	Cost per Visit
A	1000	$ 1
B	2000	3
C	4000	4
	Visits to the Site	**Visits per 1000 pop.**
A	400	400
B	400	200
C	400	100

As expected, the number of visits per 1000 population decreases as cost per visit increases. The relationship between costs and visits may be expressed in the following equation.

$$C = 5 - V$$

or

$$V = 5 - C$$

1 - Jack Knetsch. "Outdoor Recreation Demands and Benefits". *Land Economics*. XXXIX, 4. November, 1963. p. 388.

This equation may be illustrated graphically.

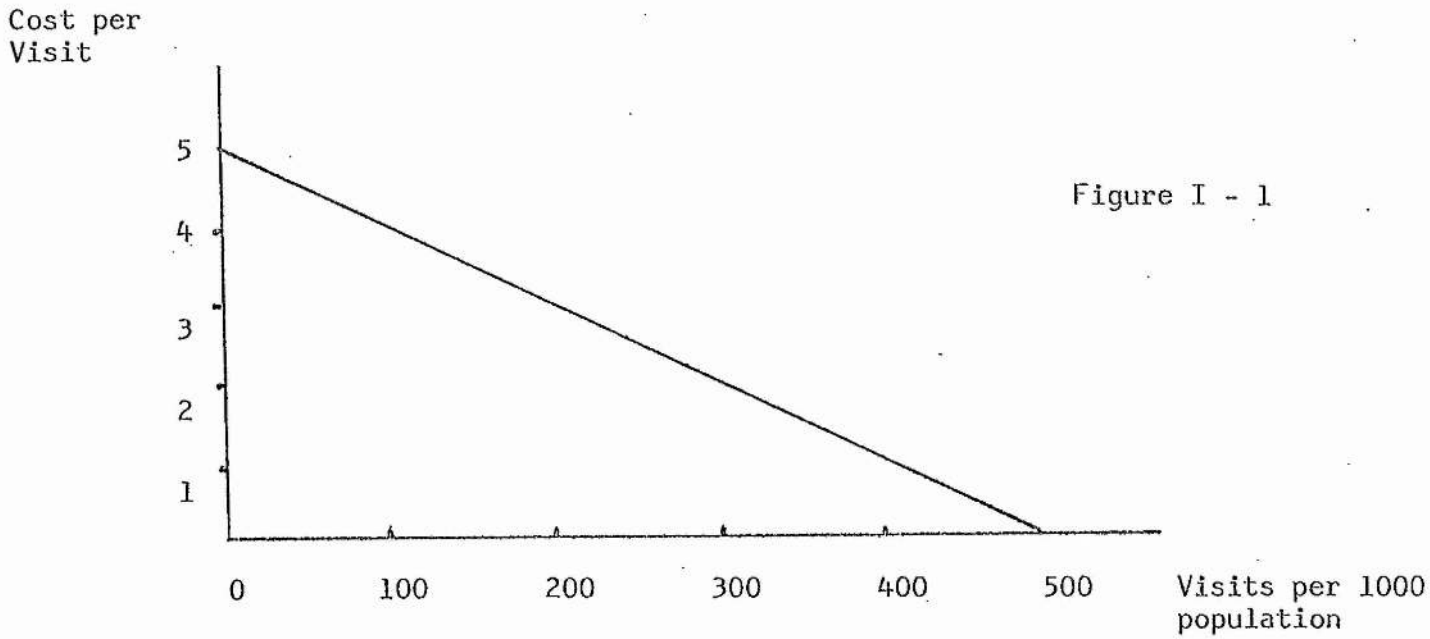

Figure I - 1

The Relationship Between Cost and Visitation Rate

The construction of the Clawson demand curve for the recreation site requires the introducing of one further assumption. It is assumed that the imposition of an entrance fee, or its increase, is viewed by visitors as being no more serious than a proportional increase in their total cost of visiting the site. In the example above, an increase in cost of $0 will result in 1200 visits. If a fee of $ 1 was to be charged, the number of visits would decrease, as expected. An increase of $ 2 would lead to a greater decline in the number of visits, and so on. The number of visits for these hypothetical increases in cost is calculated until this number, multiplied by the fee that that resulted in it, is maximum.

The concept explained above is made clearer when the example is used.

Added Cost (1)	Total Visits (2)	(3) = (1) x (2)
$ 0	1200	$ 0
1	500	500
2	200	400
3	100	300
4	0	0

With an additional fee of $ 1, the number of visits is 500. The number of visits multiplied by the amount of the fee or increase in cost is $500. With larger increases in cost, the figures in column 3 decrease. Had the resource been privately owned, $500 is the amount that the owner could have increased his revenue by had he imposed a fee of $ 1. As is evident in column 3, this is the maximum. This $500 therefore represents the amount of consumers' surplus enjoyed because there was no increase in fees. It is the value of the resource to the users.

A Clawson derived demand curve can be plotted using the information obtained in columns 1, 2, and 3 above.

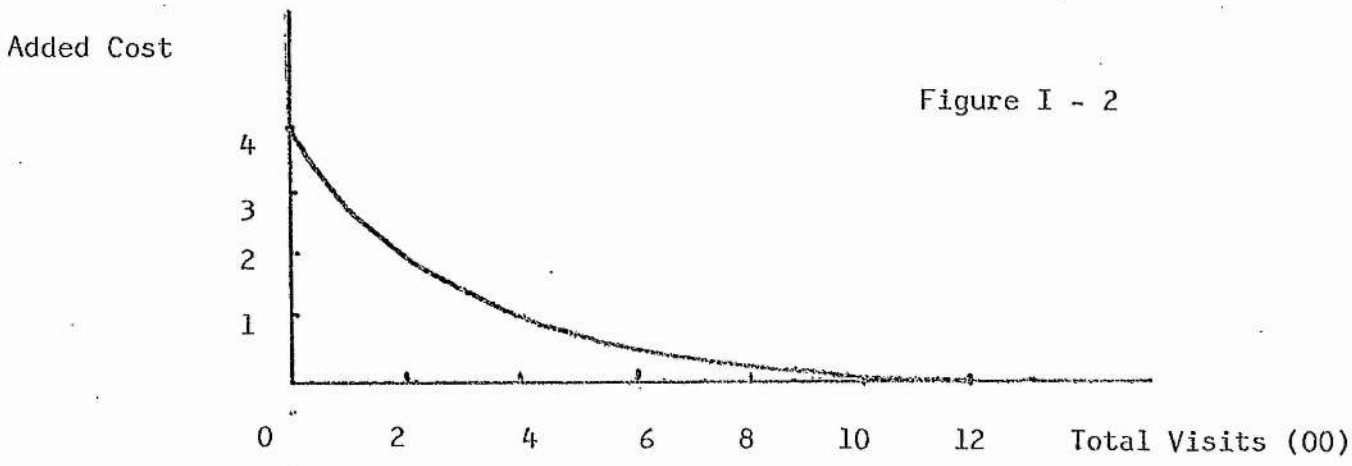

Figure I - 2

The Clawson Derived Demand Curve

Estimation of the Net Economic Value of the Oregon Salmon - Steelhead Sport Fishery Using the Clawson Method

William G. Brown, Ajmer Singh and Emery N. Castle used a direct application of the Clawson approach to estimate the value of the Oregon salmon and steelhead (SS) sport fishery in 1962.[1] From a survey conducted every month in 1962, they were able to gather the data necessary for such an application. Even though salmon and steelhead angling is not confined to one area of Oregon, the authors were able to establish distance zones based on the average distance that most anglers drove when they went fishing. The map on the next page shows how the State was divided into five main zones where the closest to SS fishing is the coastal zone. Data on the five zones are summarized below.[2]

Distance Zone	Average miles per SS fishing trip	Average variable cost per SS fishing day	Zone population	Sample SS days	SS days per 10,000 population
1	37	$ 4.02	184,147	455	24.71
2	105	6.14	455,923	721	15.81
3	140	6.00	473,861	704	14.86
4	220	12.00	229,786	144	6.27
5	120	6.71	481,421	808	16.78

1 - William G. Brown, Ajmer Smith and Emery N. Castle. *An Economic Evaluation of the Oregon Salmon and Steelhead Sport Fishery.* Corvallis, Oregon. September 1964.

2 - *Ibid.* p. 30.

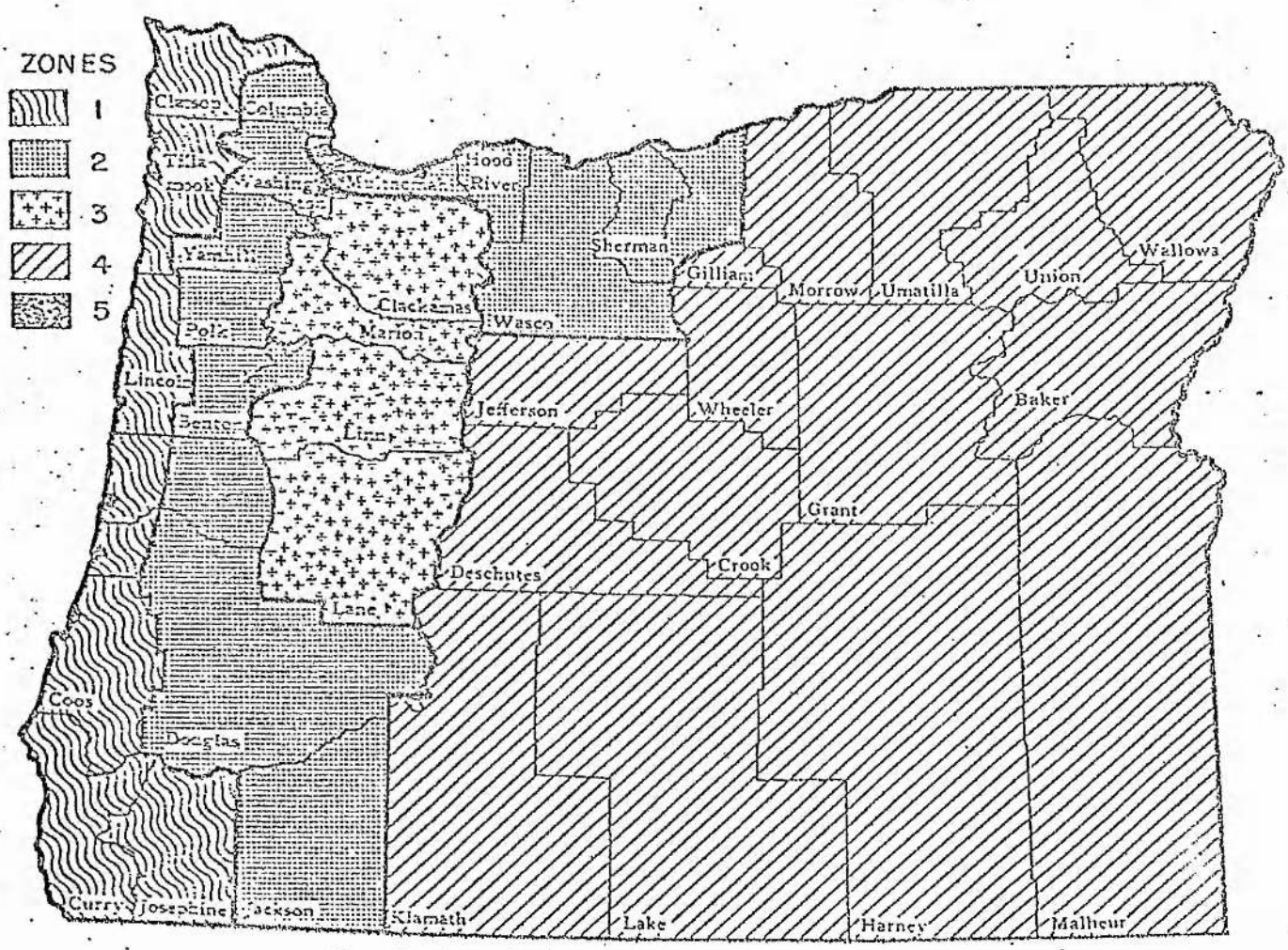

Figure 1. Geographic location of the five distance zones in Oregon.

As expected there exists a negative correlation between SS days per 10,000 population and variable cost per SS fishing day. The relationship between these two variables is portrayed graphically in Figure I-3.

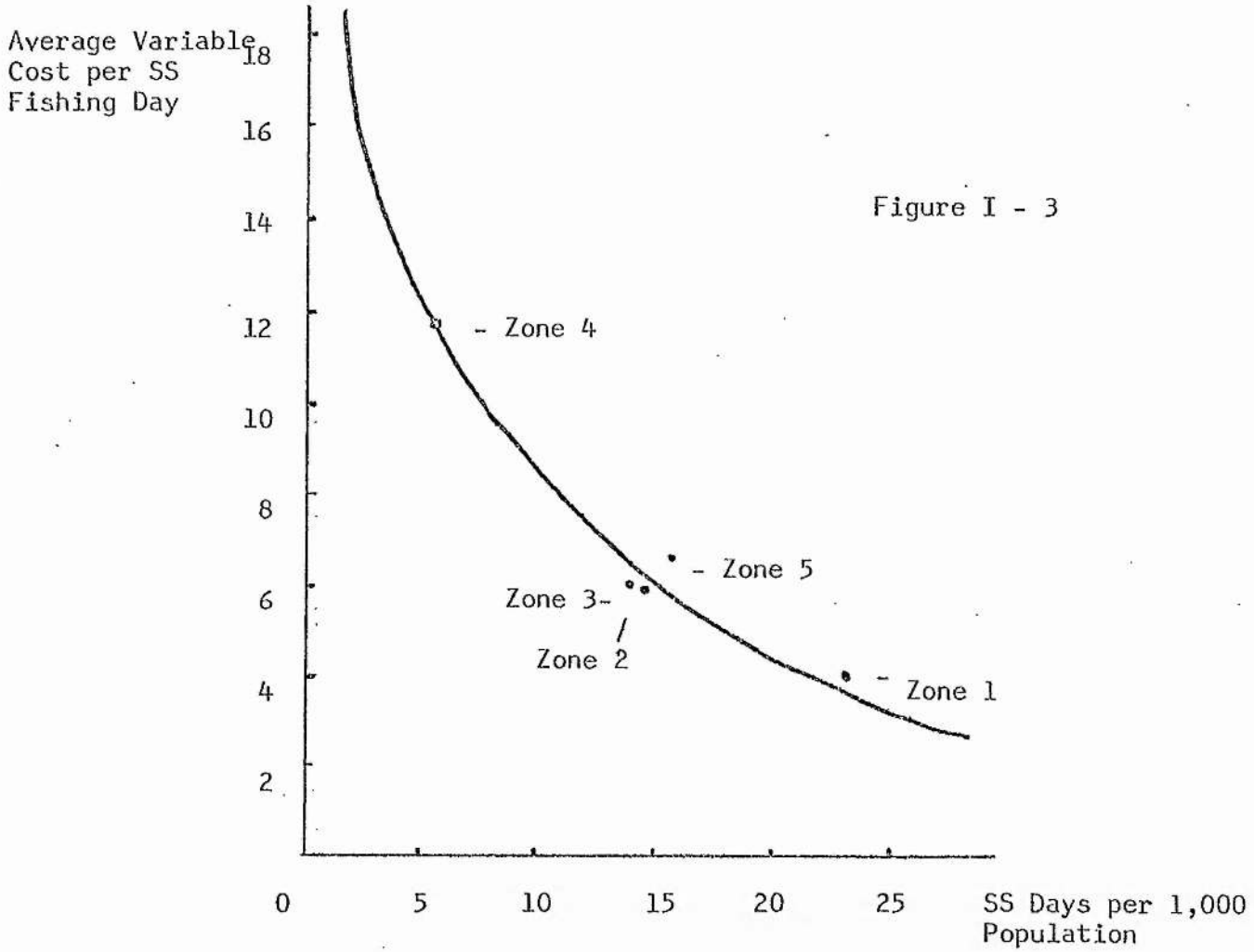

Figure I - 3

The Relationship Between Average Cost per Fishing Day and the Number of SS Days Taken per Unit of Population by the Five Main Distance Zones in Oregon

The demand curve for the fishery was plotted using the Clawson method. Increases in daily SS variable costs were assumed and the number of visits resulting from these

increases calculated. The results appear below.[1]

Distance Zone	Assumed Increases in Daily SS Fishing Costs					
	$0	1	2	4	6	8
1	171,429	144,800	122,900	88,500	63,400	45,500
2	298,587	253,500	213,600	153,700	110,400	79,100
3	317,617	269,100	227,700	163,500	117,400	84,300
4	56,921	48,200	40,900	29,200	21,100	15,100
5	286,839	242,800	206,500	147,800	105,900	76,100
Total	1,131,392	958,300	811,500	582,800	418,200	300,000

The potential revenue that could be obtained by increasing the fee for the SS fishery would be:

Daily Increase per Angler per Day	Predicted SS Days Taken (as above)	Predicted Possible Annual Revenue
$ 1	958,300	$ 958,300
2	811,500	1,623,000
4	582,800	2,331,200
6	418,200	2,509,200
8	300,000	2,400,000

The maximum net economic value of the Oregon salmon and steelhead sport fishery was therefore approximately $2.5 million in 1962.

It was suggested that this estimated value of $2.5 million per year was probably conservative as compared to estimates based on total consumers' surplus since no price discrimination is permitted in the computation.[2]

1 - *Ibid.* p. 34.
2 - *Ibid.* p. 35.

The Clawson derived demand curve, based on the results obtained above is plotted in Figure I-4.

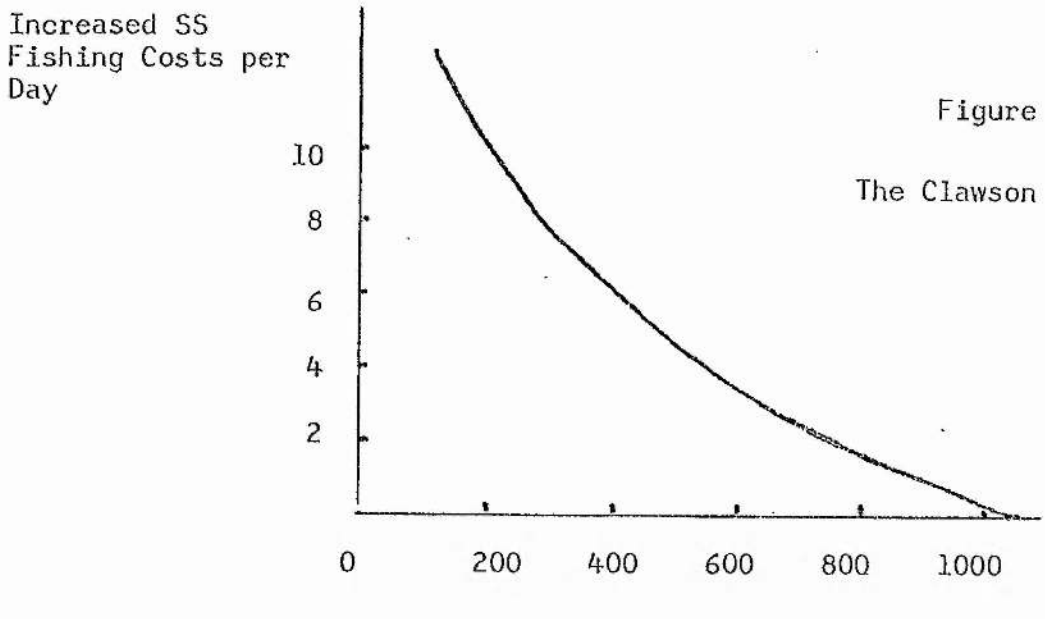

Figure I - 4

The Clawson Derived Demand Curve

Extensions to the Clawson Approach

The Clawson technique has been criticized for its assumption that the cost of travelling to a recreation site is the only factor affecting the number of visits per unit of population from each zone. Knetsch points out that "there seems no reason ... why we could not also consider other factors other than cost as determinants of visit rates."[1] He suggests three other factors which could be included in the analysis. These are income, the availability of substitutes and the congestion of people at the recreation

1 - Jack Knetsch. "Outdoor Recreation Demands and Benefits". *Land Economics*. XXXLX, 4. November, 1963. p. 390.

area. Instead of

$$V = f(C)$$

Knetsch suggests that

$$V = f(C,Y,S,G)$$

where V = the number of visits per unit of population from each zone

C = cost per visit

Y = users' income

S = substitute areas

G = some measure of congestion

Brown, Singh and Castle extended the Clawson technique to include family income as a factor affecting the number of SS fishing days taken per capita.[1] The five main distance zones were divided into thirty-five subzones based on both income and distance. It was found that income was highly correlated with both variable cost per SS fishing day and the number of per capita fishing days taken. With income included in the calculations, the ability to predict future use of the resource was expected to improve.

A discussion of the other factors that Knetsch suggested, that is, the effects of substitute areas and congestion, will be presented in Chapter III.

Knetsch also argued that money cost is not the only constraint that visitors to a site must face. Time, he said,

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1 - Brown *et al. op. cit.* p. 35-43.

is certainly another. "The demand curve constructed earlier is a relation between money costs and the number of visits, as it should be, but owing to this second (time) constraint the demand curve is consistently biased to the left of the true demand curve, that is, it is an underestimate of the actual demand for the given resource."[1] The following diagram might help to explain the influence of the opportunity cost of time on the demand for recreation.

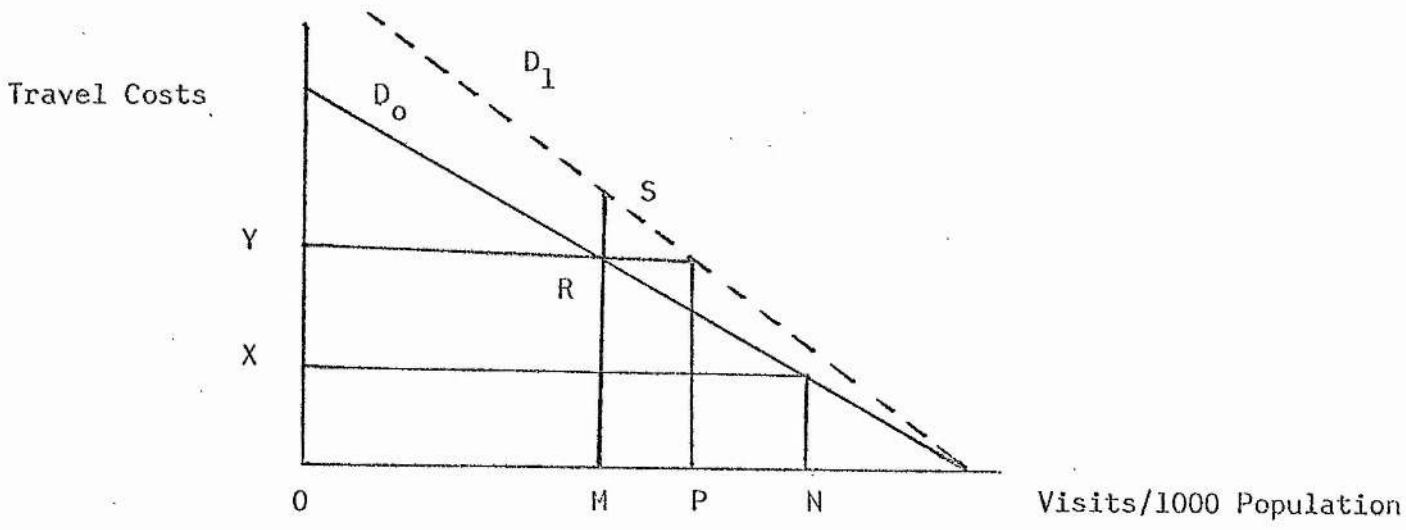

Figure I - 5

In Figure I-5, the demand curve D_0 is found by plotting the number of visitors per 1000 population from each zone against the travel costs from each zone. If costs for Zone 3 are £ OX, ON visits will be expected. Zone 4

1 - Knetsch *op. cit.* p. 395.

must pay costs of £ OY and OM visits are expected. If the costs to Zone 3 visitors were to increase to £ OY (that is, an increase of £XY), the number of visits from that Zone would be expected to fall by NM to OM. This would yield the same visitation rate as Zone 4. However, Zone 4 visitors must bear two kinds of costs--£OY (equals MR) in cash costs plus RS in opportunity of time costs since Zone 4 is further from the site than Zone 3. S is therefore a point on the corrected demand curve D_1. An increase in costs of £XY will cause visits per 1000 population from Zone 3 to drop not by NM, but by NP. This is because the opportunity of time costs would not have changed for visitors from Zone 3.

The opportunity cost of time is difficult to measure. Pearse, in his study of big game hunting in the East Kootenay district of British Columbia used the following equation to arrive at a rough estimate of the value of time.[1]

$$C_T = \frac{YT}{240}$$

where C_T = the opportunity cost of time

Y = annual income

T = the number of days spent travelling to and from the recreation site

240 = the average number of working days in a year

1 - Peter H. Pearse. "A New Approach to the Evaluation of Non-Priced Recreational Resources". *Land Economics*. XLIV, 1. p. 96.

The problem with this approach is the same problem encountered with the GNP technique used to evaluate recreation benefits. How is the time of somebody who is not earning an income to be measured? If a schoolboy decides to go fishing, is it assumed that his time is worth nothing because he has no income?

One might object to this calculation for another reason. It is not a very good way to forecast future use of a recreation area. It is assumed that the number of visits to a site is negatively correlated with the opportunity cost of time. If the opportunity cost of time increases, presumably the number of visits will decrease. To use an example, Angler X earns £ 5000 per year and it takes him four hours to travel to Loch Y. The value of his time in travel is therefore

$$C_T = \frac{5000\ (1)}{240} = £\ 20.83$$

if an eight hour working day is assumed and a return trip takes eight hours. Angler X's annual incomes rises to £ 5500. The opportunity cost of time for a return trip to Loch Y is now £ 22.92. The number of visits by Angler X would be expected to drop. However, this is intuitively wrong. A very high correlation between income and visitation rate generally exists, so with an increase in income, the number of visits should increase rather than

decrease. Similarly, if the number of working days in Angler X's year dropped to 220 while his annual income remained at £5000, he would have more leisure time. The number of visits to Loch Y should increase. However according to the Pearse equation, the value of time would rise from £20.83 to £22.73 and the number of visits would fall. Again, this result is intuitively wrong. Some calculation is needed wherein income is not a factor of the opportunity cost of time.

3. The Direct Approach

One of the more promising methods of estimating the value of recreation resources is that of the market area survey or the "direct" approach. Through a properly constructed survey, which can be conducted on the site or by mail questionnaire, one attempts to elicit from the respondents the amount that they would be willing to pay for the resource. The array of answers obtained in this fashion provides the data for the demand schedule of the aggregate of the respondents. The next step involves relating the interview sample to the population. Additional information concerning income level, education, recreation habits and so on is gathered from the respondents so that the differences in their willingness to pay can be explained by a set of variables. The population is then classified according to

the distribution of income, education and other characteristics of the sample group, and a willingness to pay is imputed for each class. The simulated demand schedule for the resource, a schedule which would indicate the total volume of use at each price, is estimated by aggregating over the population.

The direct approach is not without its drawbacks. Interviews, the subsequent tabulation and interpretation of the data are time consuming and costly. There are also statistical problems involved. All survey techniques suffer to some degree from sampling error. The sample of respondents may not be representative of the universe when too small a sample is taken or when the selection of persons to be interviewed is biased in some fashion. When proper sampling techniques are used, this source of error is minimized. A more serious problem may be that of response error which may be due to the way in which the questions are phrased, or to the unconscious influence of the interviewers or to a memory bias on the part of the respondents. In mail questionnaires yet another source of bias occurs because survey returns are seldom one hundred percent. An error would occur if there were differences (in angling success, for example) between those who returned the questionnaire and those who did not.

The data gathered must therefore be interpreted with

some caution. Respondents may have no idea themselves of their valuation of non-priced recreation resources since they have never been asked to pay for them. Their answers are subject to many kinds of bias. One such bias stems from a suspicion on the part of the respondents about the purpose of the questions. There is a very real possibility that users will not admit the true value of the recreation resource to them for fear officials might be moved to institute or increase tolls. If some application of the Clawson technique were to be used for example, and respondents were asked whether or not they would continue to visit a site given various increases in cost, it is doubtful that many would say that they would.

On the other hand, emotionalism towards a particular resource (for example, an attempt to make a case for preservation or expansion of the resource) will cause some respondents to overestimate the benefits of the resource. The Brown, Singh and Castle study seems to strike a good balance between the use of a survey to elicit necessary responses from recreation resource users, and the use of another method (the Clawson method) to evaluate user benefits. Respondent bias is not as prevalent as it would be if users were asked to reveal benefits directly.

The Design of Questionnaires[1]

In general, it has been found that the less hypothetical is the question, the more reliable is the response. As a first step then, the questions should be directed to the primary beneficiaries--the recreationists themselves, rather than toward potential consumers. It seems preferable to conduct the interview at a time when the respondent is engaged in the activity in so far as it reduces the necessity of his being able to accurately project from one situation to another. In other words, up to the point of the interview the user will have made a series of choices, consumption and expediture choices, bringing him to the particular recreation site. In addition, questions concerning willingness to pay are more relevant when actual payment is being considered.

Given this short set of guidelines, the various types of questionnaires designed to elicit the value of the resource directly from the responding user will be discussed.

One approach is to question users about the maximum price that they would be willing to pay for access to a particular site rather than be excluded from it.[2] Yet when the question is posed directly, "How much would you be

1 - Several survey questionnaires, including the one used by Brown, Singh and Castle may be found in Appendix 1.

2 - R.K. Davis. *The Value of Outdoor Recreation" An Economic Study of the Maine Woods*. Cambridge Mass. 1963.

willing to pay for the privileges offered?", the tendency to overstate or understate is prevalent.

Another approach is to ask the respondent what he believes others would be willing to spend for access to the site being studied. The bias which results from the desire of some people to appear more affluent than they are, is eliminated, and the bias which results from the fear that actual charges may be reduced.

Crutchfield recognized that if recreation services were priced, even hypothetically, that the question of a reduction in park use should be considered.[1] He proposed therefore, that users be questioned regarding the amount by which their recreation would be curtailed at various increases in fees. In other words, the users would be asked to declare the minimum amount that they would have to be "bribed" to stay away.

One survey technique which has received considerable attention is the one developed by Davis.[2] Interviews were used to determine the willingness to pay (maximum) of a sample of users of a recreation area in Maine. The interviews consisted of a bidding game in which users were asked how their use of the area would be affected if their

1 - J.A. Crutchfield. "Valuation of Fishery Resources". *Land Economics*. XXXVIII. p. 152.
2 - Davis. *op. cit.*

cost of visiting were increased. Bids were systematically bid up, or down, until the respondent switched his reaction from inclusion to exclusion, or vice versa. The mean of the excluding and the last including bid of each respondent was then taken as his willingness to pay. The demand curves of each would show that he uses the area by a constant amount below this price and not at all above it. Individual demand curves were then aggregated to obtain a value of benefits received for the population.

For purposes of comparison, the measurement of recreation benefits accrued to Loch Leven anglers using some of the methods described in Chapter I appears in Chapter III. These include the market value approach, the expenditure approach, the Pearse method, the Hotelling approach, the Trice and Wood approach as well as the most promising Clawson approach.

CHAPTER II

THE PROBLEM AT LOCH LEVEN AND COST ESTIMATES

1. The Problem at Loch Leven

For many years, Loch Leven provided anglers with some of the best fishing in Scotland and indeed in all of Britain. Anglers from all over the world would come to fish and would usually do so with a great deal of success in terms of the number of trout caught. According to many anglers, Loch Leven is now "not what it used to be". Perhaps the sentiments of these anglers are best summed up in a statement by a representative of the Dunfermline Artisan Angling Club.[1] He noted that "within many of our memories, we remember the catches every club used to take from this loch on nearly every outing. Sixty-thousand trout was the normal total catch and on at least one occasion it reached 80,000. In those days every club member had a poor outing if he didn't achieve double figures."

The statement goes on to point out that "no member of our club has caught ten trout or more in competitions over the past seven seasons." The actual catch for the years

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1 - Statement made to the Annual General Meeting of the Scottish National Angling Clubs Association, January 31, 1979.

1972 to 1978 was as follows:[1]

1972	15,330	1976	19,327
1973	16,256	1977	19,069
1974	15,889	1978	13,336
1975	26,482		

According to the representative of the Dunfermline Artisans, in 1978 it was quite a common occurance for some members of a club never to have risen a fish. "And we know of one club whose members were so disgusted with the conditions, they cancelled the rest of their competitions."

Other anglers are equally unhappy. Through the survey sent to 210 anglers, several unsolicited comments were made about the quality of angling at Loch Leven. An angler from Ayr called the loch "something of a wasted asset". He presented the following catch figures to prove his point.

Year	Number of Fish Caught
1960	80,000
1966	50,000
1969	20,000
1977	19,000
1978	14,000

According to this angler, the English reservoirs "put Loch Leven very much in the shade".

Dr. A.V. Holden of the Freshwater Fisheries

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1 - Source: Loch Leven Fisheries, Kinross.

Laboratory in Pitlochry points out that these catch figures must be put into perspective. He notes that it was only for a short time that catches were as high as reported above and that the average since the turn of the century has, in fact, been about 30,000. The 1978 catch was, nevertheless, less than fifty percent of this average.

An angler from Blairgowrie claims that Loch Leven is "almost a waste of time and money nowadays". A fisherman for thirty-six years, he caught two fish in six outings at Loch Leven in 1978. A member of the Edinburgh University Angling Club included as one of his "other expenses" (question 8 of the survey found in Appendix II) "Mental Frustration...Wouldn't go Back...No Fish in Five Trips".

Anglers are obviously becoming disenchanted with Loch Leven. Some will not go back and others are threatening to stay away. Clearly, something must be done. Dr. Holden was contacted and asked two questions. The first was, "What is causing the deterioration of Loch Leven as an angling resource?" and the second, "What can be done to improve the situation?" His letter of reply was so clear and self-explanatory that it will be presented in its entirety.

Dear Mr. Sloan,

This is really a very complex problem, in which pollution from various sources may play a part but other

natural factors must be taken into account. Recent statements by certain members of the angling fraternity regarding the deterioration in numbers of fish over recent years have been incorrect in many respects, particularly an allegation that catches in past years used to average 60,000 fish. The average in fact was much lower than this, and for many years in the first part of the century catches were well below 30,000 per annum.

With respect to the questions you ask, I can say only that the present level of pollution from sewage discharges provides the major source of phosphate input, the drainage from agricultural land being the main source of nitrate input predominantly as a result of nitrigenous fertilisers. The combined effect of these two nutrients is to stimulate the growth of algal populations in the loch, and in the late 1960's the excessive nutrient input gave rise to intense algal blooms which seemed to have had some adverse influence on angling if not on the population of trout itself. However, in that period the major source of phosphate was the woollen mill at Kinross, but this source has been largely eliminated.

My own view is that the loch would improve further if the sewage was given tertiary treatment suggested by Mr.

Drysdale,[1] because the marked reduction in phosphate discharges which would be expected following such treatment should reduce the algal populations considerably. However, one must bear in mind that a reduction in nutrient input could eventually lead to a reduction in the total biomass of fish. Trout would probably be smaller in size, though not necessarily fewer in numbers. Incidentally, one altervative which you should consider in your study, although you may reject it eventually, is the collection of all sewage discharges into a trunk sewer which would connect with the regional trunk sewer for discharge to the Firth of Forth. It is most unlikely that any material reduction in nitrate discharges from streams will be seen in the foreseeable future.

Your second question concerns the effect of the increased pike population in destroying trout. We do not know whether the pike population is larger now than it was a few years ago, but I understand that the Loch Leven authorities have been netting pike for many years. Pike cannot be eliminated by this technique, but the removal of the very large fish, if done thoroughly, will reduce predation on the trout population, and may well lead to an increase in numbers of trout but a decrease in the average

1 - Mr. P.A. Drysdale of the Forth River Purification Board, Glenrothes, was consulted prior to any correspondence with Dr. Holden.

size. Anglers are never in agreement as to whether they would like more smaller fish or fewer larger fish. It is worth bearing in mind that intensive netting of pike will also remove the larger trout, but pike netting must be continued even at the sacrifice of many of the larger trout, if the predation by pike is to be significantly reduced. Netting must also be carried out every year.

As regards to other factors affecting the trout population, it must be borne in mind that trout feed on perch fry as well as invertebrates, and the populations of perch fry are probably variable, some years providing smaller populations than others. The major factor affecting the trout population is the recruitment from the various spawning burns, and this recruitment is itself subject to various factors influencing the streams rather than the lcoh. Obviously any serious pollution of streams may reduce or eliminate juvenile trout populations at any time, but we believe that climatic variations, which give rise to low flows in critical months of some years may seriously affect the survival rate of juvenile trout. If recruitment from the streams, which usually takes place towards the end of the first or second years of life, is seriously reduced by any any of these factors, the numbers of fish available to the anglers by the time the fish have grow to takeable size (one to three years later) will be seriously affected.

If the numbers of fish are smaller it is possible in certain circumstances that they grow more rapidly, but this is dependent on other factors as well.

Finally, you ask what can be done, presumably to improve trout fishing. It is not possible to answer this question until one knows exactly what the situation is in the loch, in terms of both trout numbers and growth, and what is taking place in the streams. The task would be so enormous that it has not been possible for this laboratory to undertake any project to investigate it, and even the assessment of the trout population over a number of years is too expensive in manpower to justify its implementation. If must be remembered that the information derived from catches of fish is not directly related to the numbers of fish in the loch. Angling is dependent on many other factors including the weather conditions under which it takes place, and the angling pressure to which the loch is subjected, this in turn is dependent both on the cost to the angler, competition with other neighbouring fisheries, and the reward which the angler expects to get for his money in terms of angling success. As I have indicated, in respect to pollution there might be some benefit in reducing the phosphate input even further, but there is a risk that the overall productivity level in the loch could be materially reduced to the disadvantage of the fishery.

Reduction in the nitrate input is not feasible with present agricultural practices. However, the link between pollution and the trout population is very vague, and as the loch water is much clearer than it was in the late 1960's, with the virtual elimination of the intense algal blooms which seem to have affected angling adversely, there may be no need to reduce the nutrient discharges even further. We have no evidence that any toxic chemicals might be adversely affecting the fish, although one chemical used by the mill for mothproofing is still under investigation.

The average catch between 1873 and 1972 was about 30,000 fish, but in the second half of that period it was nearer 40,000 fish, partly as a result of the higher post-war catches. Only after 1968 has the catch fallen consistently below 20,000, and I think catches of 30,000 fish could be considered as a reasonable target for future years.

One remedial measure which might be considered is the artificial stocking of the loch with fish of takeable size, as it is done in Loch Fitty. We have not examined this problem seriously, but in view of the relatively small catches now being obtained from the natural stock, it might be necessary to add annually at least 10,000 fish of takeable size to provide a worthwhile increase in the catch. This would involve the construction of an adequate hatchery

and rearing ponds, which with the running costs would involve considerable expense, and I doubt whether the return on this could justify its operation. However, this is a problem for you to investigate.

Sincerely,

A.V. Holden.

2. Cost Estimates

As Dr. Holden pointed out, a further reduction in the nutrient input to Loch Leven could eventually lead to a reduction in the overall biological productivity of the loch. He also notes that the water is clearer now than it was ten years ago. Now that the new sewage treatment system at Kinross is near completion, the pollution of Loch Leven is no longer such an urgent problem. Why then has the quality of angling deteriorated to such an extent?

The answer to this question seems to be two-fold. Pike are definitely a problem. Both Dr. Holden and the members of various angling associations recognize that steps must be taken to eliminate this predator. The second problem seems to be that the loch is simply being over-fished--hence Dr. Holden's suggestion that it be artificially stocked. Two costs will therefore be investigated. These are: 1) the costs involved in reducing the pike population and 2) the costs involved in the

construction and maintenance of a fish hatchery.

The Cost of Netting Pike

There are three costs to be considered here. They are 1) the cost of hiring men to do the netting, 2) the cost of boats and 3) the cost of nets.

According to Dr. Holden, netting should be carried out from February to April every year in order to catch the pike when they spawn in shallow water. If this operation was to be carried out twice a week for thirteen weeks, there would be a total of 26 to 30 outings per year, and if two boats and four boatmen were used each time, 60 boats and 120 boatmen would be required every year. Loch Leven Fisheries charge £ 8.00 per day for the hire of a boat, so the maximum annual boat expense would be £ 480.00. The boatmen at Loch Leven are paid £ 15.00 to £ 20.00 daily for their service to anglers, so the maximum annual boatman expense would be £ 2400. The total annual expense would therefore be £ 2880.00

Nets would have to be purchased in order to carry out the elimination of pike. Mesh sizes of the nets used for pike are in the range of 3 to 5 inches stretched mesh. The cost of this type of net is £ 50.00 plus VAT.[1] The total

1 - This figure was quoted by Mr. A Taylor of W. & J. Knox Ltd. of Kilbirnie in Ayrshire, a company that specializes in nets of this sort.

cost of netting pike would therefore be as follows.

Type of Expense	Number	Total Amount
Nets	1 at £ 57.50	£ 57.50
Boats	60 at £ 8.00	£ 480.00/year
Boatmen	120 at £ 20.00	£ 2400.00/year

The Cost of Constructing and Maintaining a Fish Farm

In order to stock Loch Leven with the unique Loch Leven Trout, the construction and operation of a fish farm would be necessary. Louise Varley, formerly of the Unit of Aquatic Pathobiology at the University of Stirling, has summarized the costs of building and maintianing five different systems of farm.[1] The various capital and operating costs will now be discussed.

i) Capital Costs

The five systems that Varley describes are:

1) a system using unlined earth ponds

2) one using lined earth ponds

3) sea cages

4) a system using concrete raceways

5) a system using fibreglass tanks.

Each of these systems may use either gravity-fed water or pumped water (with the exception of the sea cages

1 - R. Louise Varley. "Economics of Fish Farming in the United Kingdom". *Fish Farming International*. March, 1977.

which use gravity-fed water only). The following capital cost figures for a farm producing 50 metric tons of trout per year were calculated.[1]

Item	(1976)
Hatchery (egg trays, pipes, buildings)	£ 1,000
Early-rearing (fry tanks, pipes, buildings)	8,200
On-growing facilities	
1) Earth ponds (unlined)	2,000
2) Earth ponds (lined)	4,900
3) Sea cages	8,000
4) Concrete raceways	12,500
5) Fibreglass tanks	30,000
Combined Requirements	
(land, buildings, water supply, vehicles)	
i) gravity-fed water	10,500
ii) pumped water	25,000

1 - *Ibid.* p. 17.

TOTAL CAPITAL COSTS[1]

Holding Facility	(i)	(ii)
1) Earth ponds (unlined)	£ 21,700	£ 36,200
2) Earth ponds (lined)	24,600	39,100
3) Sea cages	27,700	-
4) Raceways	32,200	46,700
5) Fibreglass tanks	49,700	64,200

i) gravity-fed water ii) pumped water

The cost of construction and construction materials has increased since 1976 as follows:[2]

1975 = 100.0
1976 = 122.4
1977 = 145.9
1978 = 158.0
1979 (March) = 170.7

The revised capital cost figures for 1979 would be as follows:

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1 - *Ibid.* p. 17.
2 - Source: Central Statistical Office. *Monthly Digest of Statistics.* June, 1979.

Item	(1979)
Hatchery	£ 1,400
Early-rearing	11,500
On-growing facilities:	
1) Earth ponds (unlined)	2,800
2) Earth ponds (lined)	6,800
3) Sea cages	11,200
4) Raceways	17,400
5) Fibreglass tanks	41,800
Combined requirements:	
i) gravity-fed water	14,600
ii) pumped water	34,900

TOTAL CAPITAL COSTS

Holding Facility	(i)	(ii)
1) Earth ponds (unlined)	£ 30,300	£ 50,500
2) Earth ponds (lined)	34,300	54,500
3) Sea cages	38,600	-
4) Raceways	44,900	65,100
5) Fibreglass tanks	69,300	89,500
	i) gravity-fed water	ii) pumped water

ii) Operating Costs

Operating costs are divided into two types--fixed operating costs and variable operating costs. Again, these costs are calculated for a farm producing 50 tons of trout per year. Loch Leven's requirements are approximately one-tenth of this amount. This point will be expanded upon later in this section. The fixed operating costs (50 tons) for 1979 (adjusted from Varley's 1976 figures) are as follows:

FIXED OPERATING COSTS

	Depreciation[1]		Interest[2]		Administration	Rent, Rates, Insurance	Maintenance
	(i)	(ii)	(i)	(ii)			
1 -	2340	4513	4545	7575	3600	2900	1400
2 -	2628	4710	5145	8175	3600	2900	700
3 -	3680	-	5790	-	3600	2900	1100
4 -	3158	5242	6735	9765	3600	2900	600
5 -	4378	6462	10395	13425	3600	2900	400

1 - Calculated on a straight-line basis.
2 - Interest is assumed to be 15 percent per year.
3 - While the inclusion of both depreciation and interest expenses may be acceptable for accounting purposes, for the purposes of economic analysis such inclusion amounts to double-counting of the same cost. It should be noted therefore that the total costs calculated are an overestimate of the real costs and that the benefit-cost ratios calculated in Chapter IV are underestimated as a result.

VARIABLE OPERATING COSTS

Labour	Food	Selling & Transport[1]	Eggs	Power (i)	Power (ii)
1 - 15200	21600	2200	1400	2160	10800
2 - 15200	21600	2200	1400	2160	10800
3 - 15200	21600	2200	1400	2160	-
4 - 12600	21600	2200	1400	2160	10800
5 - 9900	21600	2200	1400	2160	10800

"Decisions on the type of system to be used should be based mainly on considerations of the site, the capital available, and the experience of the operator".[1] As a general rule, the more capital intensive facilities tend to have lower associated risk factors since the success of the farm depends on the quality of management and husbandry.

For purposes of comparison, the total capital and operating costs of the least expensive and the most expensive systems will be calculated. These are the systems using 1) unlined earth ponds and 2) fibreglass tanks. Again, note that these costs are for a farm producing 50 metric tons of fish per year.

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1 - These costs are discussed later in this chapter.

THE COSTS OF FISH FARMING

1) Capital Cost

i) Earth ponds (unlined) gravity-fed water	£ 30,300
ii) Fibreglass tanks pumped water	89.500

2) Fixed Operating Costs

i) Earth ponds (unlined) gravity-fed water	14,875/yr.
ii) Fibreglass tanks pumped water	26,787/yr.

3) Variable Operating Costs

i) Earth ponds (unlined) gravity-fed water	42,560/yr.
ii) Fibreglass tanks pumped water	45,900/yr.

Louise Varley notes that the "capital costs of a five tonne per annum farm (10,000 fish at 500g or 17.6 oz. per fish) are normally much more than 10 percent of the costs of a 50 tonne per annum farm, as there are significant economies of scale, particularly in buildings."[1] As a rough estimate, she argues, the capital cost of a 50 tpa farm. "Operating costs are also affected (by economies of scale) but to a lesser extent."

Since Loch Leven's requirement are approximately five

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1 - Source: Letter from R. Louise Varley. October 10, 1979.

tonnes per year, a revised set of cost figures may be calculated. Capital costs are assumed to be 20 percent of those for a 50 tonne per annum and operating costs are assumed to be 15 percent of those for a 50 tonne farm.

LOCH LEVEN FISH FARM COSTS

1) Capital Cost	
i) Earth ponds (unlined) gravity-fed water	£ 6,060
ii) Fibreglass tanks pumped water	17,900
2) Fixed Operating Costs	
i) Earth ponds (unlined) gravity-fed water	2,231/yr.
ii) Fibreglass tanks pumped water	4,018/yr.
3) Variable Operating Costs	
i) Earth ponds (unlined) gravity-fed water	6,384/yr.
ii) Fibreglass tanks pumped water	6,885/yr.

The present value of these costs, as well as the present value of the cost of netting pike may now be

calculated using the formula

$$PV = \sum_{t=1}^{n} \frac{a}{(1+r)^t}$$

where t = time

s = the annual payment to be discounted

r = the rate of discount

n = the expected life of the project

Since Varley used a rate of interest of 15 percent in her calculations, and since interest rates continue to be high worldwide, a discount rate of 15 percent will be used in this study. Therefore, r = 15 percent.

The maximum expected life of the fish farms may be calculated using Varley's figures. The formula for straight line depreciation is

$$D = \frac{C - R}{n}$$

where D = the annual amount of depreciation

C = the capital cost of the item

R = the residual value of the item at the end of its expected life

n = the expected life

To calculate the maximum life of the system using unlined earth ponds and gravity-fed water, assume R = 0. The expected life of this system (n) is therefore 12,47 years. For the system of fibreglass tanks using pumped

water, the maximum expected life is 13.85 years.

Since Loch Leven would not be selling any of the fish produced on the farm commercially, the selling and transport component of the variable operating costs (equal to £ 330 for both systems) may be eliminated.

The present value of all costs (including those associated with the netting of pike) if the earth pond system was used is equal to

$$\sum_{t=1}^{12.47} \frac{11165}{(1.15)^t} + 6117.50 = £\ 67,523$$

If the more expensive fibreglass tank system was used, the present value of costs would be equal to

$$\sum_{t=1}^{13.85} \frac{13453}{(1.15)^t} + 17957.50 = £\ 94,700$$

These present value estimates will be compared to benefit estimates in order to arrive at a benefit-cost ratio.

CHAPTER III

THE CALCULATION OF PRIMARY BENEFITS

The following chapter will deal with the estimation of the primary benefits accrued to users of Loch Leven in 1978. For reasons that will be made clear later, a considerable portion of this chapter has been allocated to the discussion of the Clawson approach to the calculation of benefits, although estimates based on other techniques will also be presented.

1. The Anglers' Surveys

In order to apply some form of the Clawson approach to the calculation of angler benefits at Loch Leven, the amount that the anglers spent to fish the loch had to be established. This is done most effectively by way of the direct survey approach in their studies. D.A. Benson, in his study of hunting and fishing in Canada surveyed hunters and fishermen in 1961. Pearse surveyed hunters of the East Kootenay District of British Columbia. Robert Davis surveyed users of the Maine Woods and Brown, Singh and Castle used the direct approach to calculate the net economic value of the Oregon salmon and steelhead sport fishery. Surveys have also been used in the calculation of

secondary benefits. Two such surveys, the Tayside Study and the 1978 British Open Study will be discussed in Chapter IV.

Brown, Singh and Castle drew their survey sample from fishing licence applications in Oregon.[1] Fishing licence information was not available for Loch Leven, so another approach had to be taken. According to Mrs. Falconer, the Manager of Loch Leven Fisheries, much of the angling at the loch is done through clubs that had booked boats for 1979 and the names and addresses of the secretaries of twenty-four representative clubs in Scotland and England were obtained and the secretaries contacted. They were sent the questionnaire and letter that appear in Appendix 2 on March 10, 1979.

Following a letter of reminder, which also appears in Appendix 2, seventeen of the twenty-four secretaries returned the questionnaire and of these, thirteen expressed a willingness to assist with the angler survey. The locations of these thirteen clubs are indicated on the maps on the following two pages. The questions from, and responses to the secretaries' survey will now be discussed.

Question one simply asked whether the secretaries wished to assist in the research. Question two was an attempt to establish how many anglers stayed overnight at

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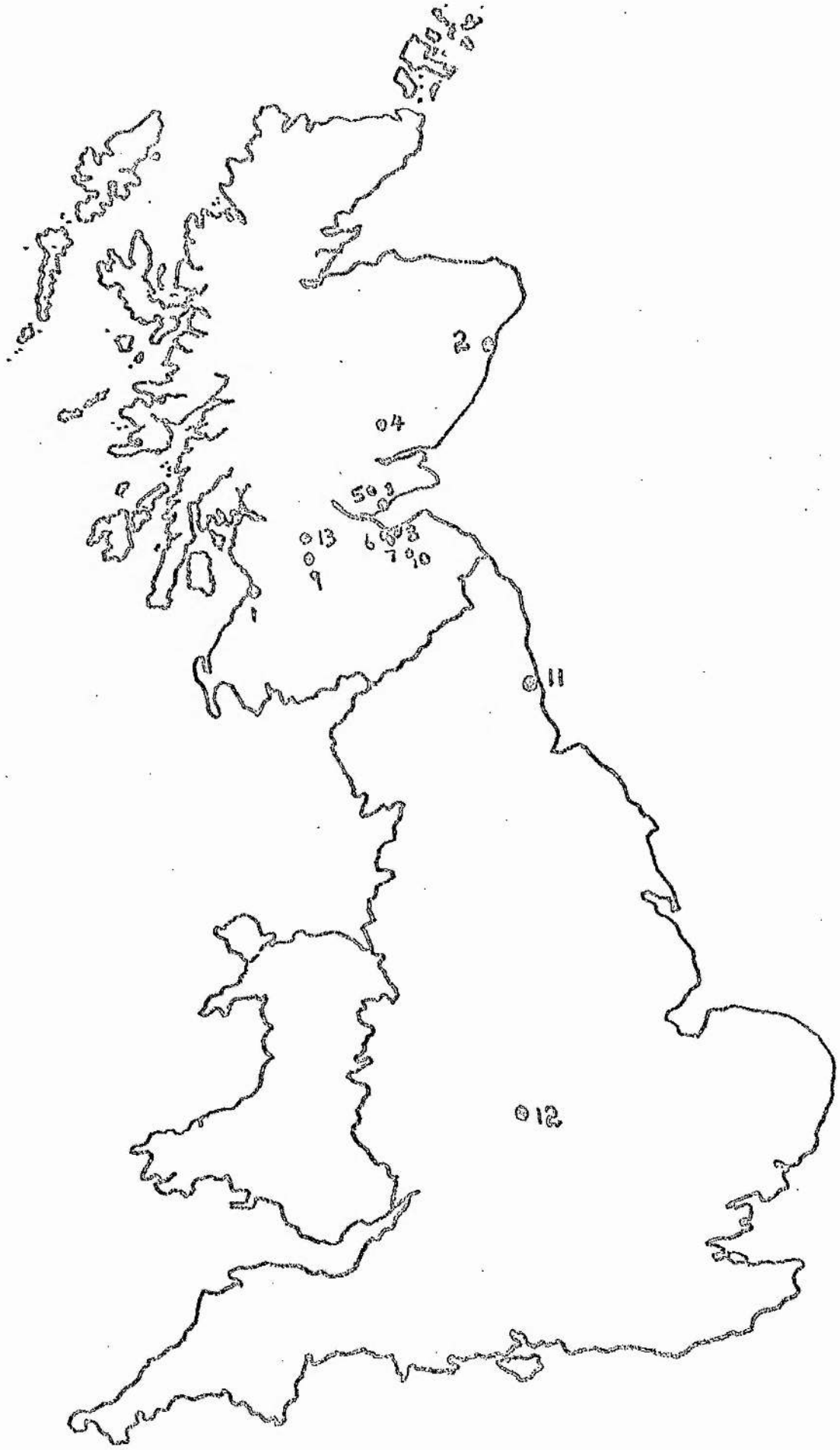
1 - Brown, Singh and Castle. *An Economic Evaluation of the Oregon Salmon and Steelhead Sport Fishery*. Corvallis, Oregon, 1964. p. 12.



THE LOCATIONS OF THE THIRTEEN CLUBS SURVEYED

THE LOCATION OF THE ELEVEN SCOTTISH CLUBS SURVEYED

Loch Leven. As the completed surveys were returned, it became evident that very few anglers did in fact stay overnight in the Kinross area. This proved to be significant since the amount spent by day visitors was considerably less than the amount spent by overnight visitors. The third and fourth questions were asked in order to discover what the anglers paid for independently so that the correct questions may be asked in their surveys. It was found that any fee paid to the club covered boat hire expenses. Other items such as transportation, lodging where applicable), meals and equipment were paid for by the angler.

Question five asked the secretaries how they would like the anglers' surveys distributed. Eleven of the thirteen secretaries decided to distribute the questionnaires themselves while two provided names and addresses. It is believed that the clubs' response would not have been as good as it was if this choice had not been given. Certainly, by distributing the questionnaires themselves, the secretaries were required to do more work, however the anonymity of the members was assured. Also, associations do not usually like to circulate the names and addresses of their members for fear of harrassment.

The number of surveys sent to each club was equal to the number of boats booked by that club for the 1979 season,

up to a maximum of fifty.

The final question was an attempt to induce the various secretaries to respond. Since anglers are concerned about the state of Loch Leven, it was felt that if they could see the results of their contribution, they might be more cooperative. This approach seems to have been successful since all thirteen of the secretaries replied to question six in the affirmative.

After all the secretaries' surveys had been received and the responses analysed, the anglers' surveys were drawn up. Both the questionnaires for day and overnight visitors to Loch Leven may be found in Appendix 2. A total of 210 of these surveys were mailed and 114 or 54.3% were returned. This relatively low response may be explained in two ways. Since mail surveys involve no personal interviewer/ respondent contact, there is less chance of a reply. Also, no letters of reminder were mailed to the anglers since their names and addresses were not known, and it was felt that the secretaries of the various clubs could not be imposed upon too much.

The number of respondents from each club appears below.

Name of Club	Number of Questionnaires Sent	Number Returned
1) Ayr Angling Club	10	7
2) Aberdeen Corp. Transport A.C.	9	6
3) Aberdour Angling Club	27	9
4) Blairgowrie and Rattray A.C.	10	6
5) CISWO Angling Club - Cowdenbeath	25	10
6) Edinburgh University Angling Club	5	3
7) Edinburgh Trout Anglers	6	1
8) EMAC - Edinburgh	13	9
9) Sunday Post A.C. - Glasgow	13	6
10) Leukaemia Foundation A.C. - Ratho	6	5
11) West End Angling Club - Newcastle	8	5
12) English International A.C. - Warks	28	14
13) South of Scotland Electricity Board Glasgow	50	33
	210	114

These anglers accounted for 926 outings which represented 3.2% of the total of 28,923 calculated below.

Questions one and two of the anglers' questionnaires are self-explanatory. Question three was asked in order to establish the total number of outings made by all anglers in 1978. The results are tabulated below.

Total Boats Hired in 1978	Average Number per Boat	Total Outings
10,113[1]	2.86	28,923

Questions four and seven are related. The total amount from question seven was multiplied by the percentage recorded in question four to estimate the amount of

1 - Source: Loch Leven Fisheries.

equipment expense for 1978 that should be allocated to Loch Leven. It must be assumed that the total amount spent by all anglers is the same every year. In other words, it is assumed that the spending pattern established through the survey is representative of the annual spending patterns of all anglers every year. Individual expenditures per outing ranged from £ 0 to £ 8.60 in 1978. The average was £ 1.61.

Through question five, it was established that most anglers travelled to Loch Leven by automobile in 1978. Only seven percent of the 926 sample outings were accounted for by anglers using a form of transportation other than the automobile. Automobile costs were calculated at 10 pence per mile and individual costs were based on the number of passengers per vehicle. The average number per car was calculated at 2.33.

Question six was probably the most difficult for the anglers to answer since most would not remember the exact amounts spent on food and beverage. The anglers received their questionnaires seven to twelve months after their last visits to Loch Leven and cannot be expected to recall exact amounts after that length of time. However, the range of food and beverage expenses recorded in the questionnaires was not very wide, so it may be assumed that the question was answered reasonable accurately. The average amount spent by day visitors was £ 1.87 per outing,

and by overnight visitors, £ 7.09 per outing.

Overnight visitors were asked how much they spent for lodging per night at Loch Leven (question eight). The average amount per night in 1978 was £ 9.32. All overnight visitors surveyed stayed in a hotel.

All anglers were asked to list any additional expenses incurred during their 1978 trip(s) to Loch Leven. Most left this section blank. Those who did complete it listed items such as bridge tolls, food and lodging expenses for their wives, and other equipment expenses not listed in their responses to question seven.

Finally, the anglers were asked to indicate on a map the name and location of the town in which they lived. This facilitated the calculation of transportation expenses to and from Loch Leven. It was assumed that anglers used the fastest and most direct route from their homes to the loch, and the calculation of travel costs was made as follows:

$$E = \frac{2D\ (.10)}{N}$$

where: E = travel costs

D = the distance from the angler's home town to Loch Leven

N = the number of passengers per automobile.

The Hon. Secretary of the Scottish National Angling Clubs Association noted that anglers come from all over the

world to fish at Loch Leven.[1] Since accurate expense data was not available for these sportsmen, it was decided to exclude them from the benefit calculations. A trip to Loch Leven may account for only a portion (albeit a large portion for dedicated anglers) of a Canadian, American or Australian's time in Britain. It is difficult to establish which travel, clothing and other expenses should be allocated to the time spent at Loch Leven. To include all expenses would certainly result in an extreme distortion of the calculations. For this reason, the benefits of Loch Leven to Scottish anglers only will be calculated.

Approximately five percent of all outings at Loch Leven were made by non-Scottish anglers in 1978. In other words, Scottish anglers accounted for 27,477 outings. The Turfhills Tourist Centre at Kinross estimates that only one percent, or 275 outings, were accounted for by anglers who stayed overnight at or near Kinross. Therefore, the total number of outings by Scottish anglers at Loch Leven in 1978 may be broken down as follows:

Outings by Day Visitors	Outings by Overnight Visitors	Total
27,202	275	27,477

It should be noted that accurate information about the distance travelled by anglers accounting for 14,099 or 51.3%

1 - Source: Letter received from A.S. Nicoll, Hon. Secretary of The Scottish National Angling Clubs Association. April 18, 1979.
2 - Source: Letter received from A.F. Christie, Managing Director of The Turfhills Tourist Centre. April 23, 1979.

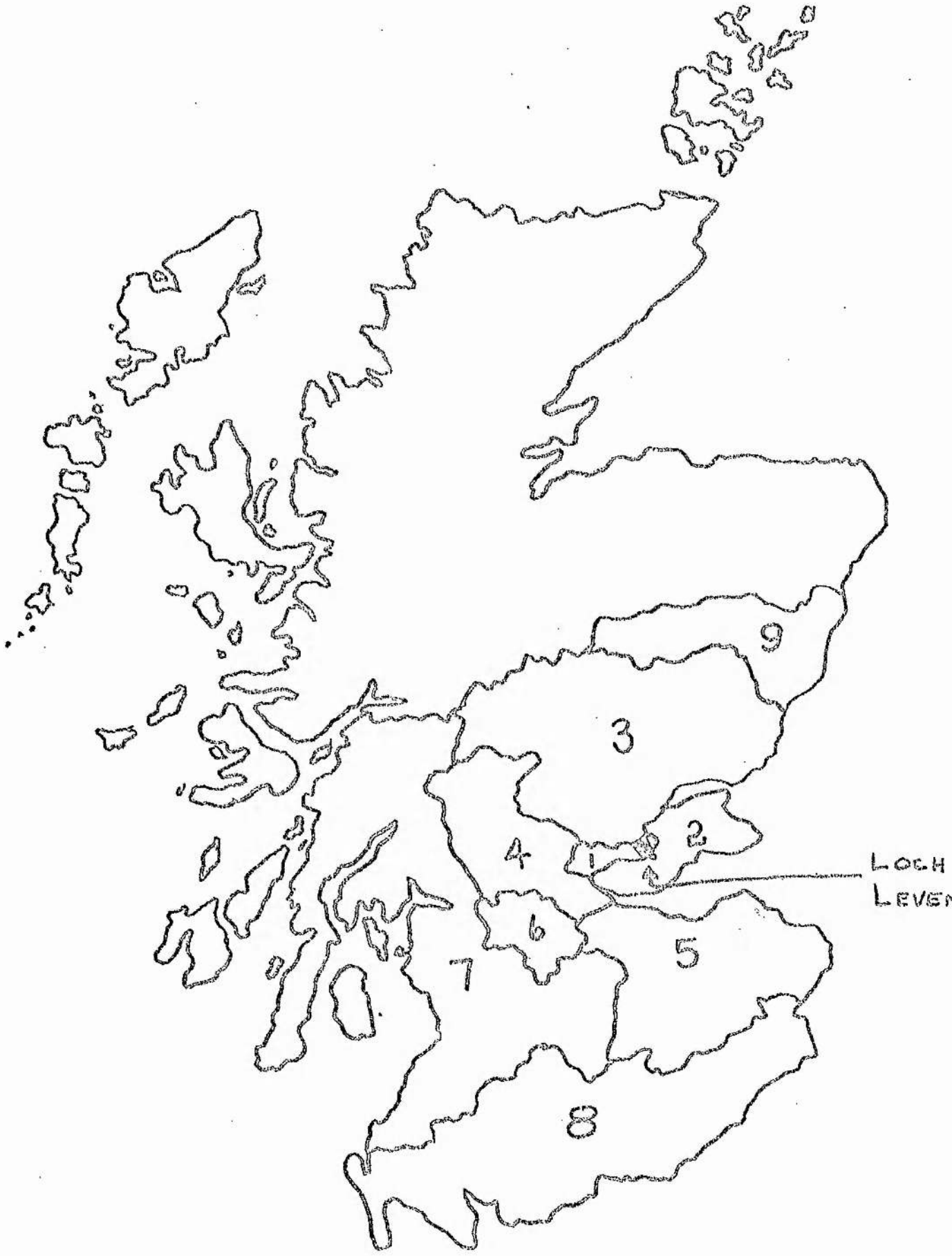
of the 27,477 outings was available.[1] Transportation costs for these anglers could be calculated. Information on other expenses (food, equipment, lodging etc.) was gathered from the survey.

2. The Clawson Method Applied to Loch Leven

The first step taken towards the application of the Clawson method is to divide the area under study into distance zones as Hotelling suggested. On the following page, a map showing the division of Scotland into nine such zones is presented. The composition of each zone is as follows:

Zone Number	Area(s) of Scotland Represented
1	Kinross and Clackmannan
2	Fife
3	Tayside Region
4	Central Region (except Clackmannan)
5	Lothian Region, Tweeddale, Ettrick and Lauderdale and Berwickshire.
6	Glasgow, Clydebank, Bearsden, Milngavie, Strathkelvin, Cumbernauld and Kilsyth, Monklands, Motherwell, Hamilton and Lanark
7	East Kilbride, Eastwood, Cumnock and Doon Valley, Kyle and Carrick, Cunninghame, Kilmarnock, Renfrew, Inverclyde, Dumbarton, Argyll and Bute.
8	Dumfries and Galloway Region and Roxburgh
9	Aberdeen, Kincardine and Deeside.

1 - Based on information obtained through Loch Leven Fisheries. See p. 64



THE NINE DISTANCE ZONES AROUND LOCH LEVEN

The number of boats hired from each zone was then calculated using the booking lists obtained through Loch Leven Fisheries, and the total number of outings for each zone was estimated. The sample represents 51.3% of the total number of Scottish boats hired in 1978. The table below presents the estimated number of boats and outings for each zone.

Zone Number	Boats Hired	Boats Hired	Total Outings[1]
1	549	1,070	3,060
2	1,659	3,233	9,246
3	885	1,724	4,931
4	267	520	1,487
5	1,005	1,959	5,603
6	311	606	1,733
7	216	421	1,204
8	8	15	44
9	30	59	169
	4,930	9,607	27,477

Crucial to the Clawson method is the calculation of the number of visits per unit of population. In this study, the number of outings (separate individual excursions on to Loch Leven) will be calculated per 1,000 population in each zone. The results of these calculations appear on the following page.

1 - Based on 2.86 anglers per boat.

THE NUMBER OF OUTINGS PER 1000 POPULATION FROM EACH DISTANCE ZONE

Zone Number	Population	Outings	Outings per 1000 Population
1	52,522	3,060	58.26
2	327,131	9,246	28.26
3	391,183	4,931	12.61
4	216,928	1,487	6.85
5	808,700	5,603	6.93
6	1,629,202	1,733	1.06
7	946,312	1,204	1.27
8	178,587	44	.25
9	245,163	169	.69
	4,795,728	27,477	

In order to estimate transportation costs, the average distance travelled from each zone to Loch Leven must be measured. The following per zone calculations represent a weighted average from each town within the zone. The towns are those from which boats were hired in 1979. As indicated earlier in this chapter, transportation costs were calculated at 10 pence per mile.

TRANSPORTATION COSTS FOR A RETURN TRIP TO LOCH LEVEN
(based on a per mile cost of 10p)

Zone Number	Average Distance to Loch Leven	Transportation Costs
1	11.50	.99
2	17.12	1.47
3	27.86	2.39
4	31.42	2.70
5	32.84	2.82
6	52.42	4.50
7	72.75	6.24
8	74.00	6.35
9	98.00	8.41
	D* = 27.61	T* = 2.37

D* and T* are weighted averages.

It is now possible to estimate the gross expenditures of Loch Leven anglers in 1978. These expenditures are itemized below for both day and overnight visitors and a weighted average for all visitors is then calculated. These estimates do not represent the net economic value of the resource. They do form the basis for the calculation of the net economic value. They also indicate the magnitude of the economic activity generated by Loch Leven and, as will be seen in Chapter IV, the calculation of secondary benefits accrued is based on gross expenditure data.

GROSS EXPENDITURES BY DAY VISITORS TO LOCH LEVEN
(average per outing)

Item	Average Cost per Outing
Boat Hire	2.80
Food and Beverage	1.87
Equipment (all angling)	1.61
Other Expenses	.24
	6.52

GROSS EXPENDITURES BY OVERNIGHT VISITORS TO LOCH LEVEN
(average per outing)

Item	Average Cost per Outing
Boat Hire	2.80
Food and Beverage	7.09
Equipment (all angling)	1.61
Lodging	.24
Other Expenses	
	21.06

The weighted average per outing expenditure by all Loch Leven anglers (day and overnight visitors) was £ 6.67 in 1978. Add to this an average transportation cost of £ 2.37, and the average Loch Leven angler can be described. He travelled 27.61 miles to fish at Loch Leven and spent £ 9.04 per outing to do so.

Total expenditures by Scottish anglers for 1978 are calculated as follows:

TOTAL GROSS EXPENDITURES

Average Expenditure per Outing	Total Outings	Total Expenditures
£ 9.04	27,477	£ 248,392

Scottish anglers spent an estimated total of £248,000 to fish at Loch Leven in 1978.

Given the weighted "base cost" (average cost per outing less transportation cost), the total average cost per zone may be estimated.

AVERAGE COST PER OUTING PER ZONE

Zone Number	Weighted Average Base Cost per Outing	Transportation Cost	Total Cost per Outing
1	6.67	.99	7.66
2	6.67	1.47	8.14
3	6.67	2.39	9.06
4	6.67	2.70	9.37
5	6.67	2.82	9.49
6	6.67	4.50	11.17
7	6.67	6.24	12.91
8	6.67	6.35	13.02
9	6.67	8.41	15.08

It should be noted that the base cost is the same for every zone. It is assumed that distance does not affect costs, except those for transportation.

Clawson's method involves analysis of the relationship between visits (or outings) per unit of population and cost per visit (or outing). As expected, there is a strong negative correlation between these two

variables in this case--equal to -.71. The pattern of this relationship is clearly visible in the table below.

COST PER OUTING AND OUTINGS PER 1000 POPULATION FOR EACH DISTRICT ZONE

Zone Number	Outings per 1000 Population	Cost per Outing
1	58.26	7.66
2	28.26	8.14
3	12.61	9.06
4	6.85	9.37
5	6.93	9.49
6	1.06	11.17
7	1.27	12.91
8	.25	13.02
9	.69	15.08

This high negative correlation is not surprising considering that on average, more than one-quarter of the anglers' total per outing cost is accounted for by transportation expenditures.

Cost per outing has been plotted against outings per 1000 population in Figure III - 1. As mentioned in Chapter I, Section 2, there are factors other than cost which may affect demand. These will be discussed in Section 3 of this chapter.

Clawson's procedure may be used to estimate the number of outings per zone given assumed increases in cost for each zone. The new increased costs were put into the equation

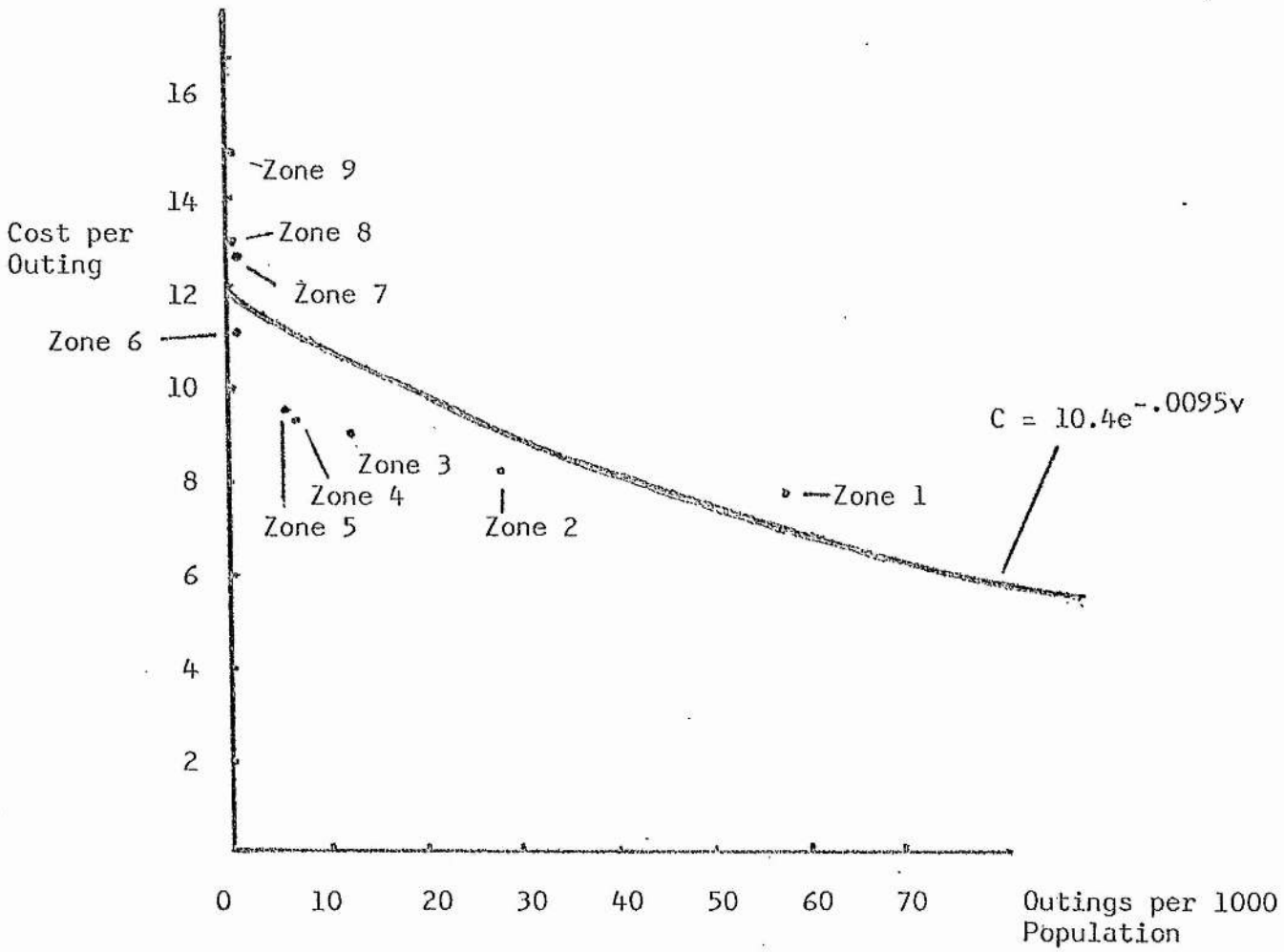


Figure III - 1. The Relationship Between Cost per Outing and The Number of Outings per 1000 Population Taken by Loch Leven Anglers in 1978.

$$C = 10.4e^{-.095v}$$

or

$$V = \frac{2.34 - \ln C}{.0095}$$

where: $v = V_i - \bar{V}$

$\bar{V} = 12.91$ (unweighted)

V_i = outings per 1000 population for each i^{th} zone

$\ln C$ = the natural log. of the new cost(s)

The following results were obtained:

PROJECTED NUMBER OF OUTINGS TAKEN BY THE NINE DISTANCE ZONES WITH ASSUMED INCREASES IN COST PER OUTING

Zone Number	Assumed Increases in Cost per Outing			
	1	2	3	4
1	£ 1,694	£ 1,090	£ 525	£ 32
2	8,697	5,260	2,013	-
3	6,290	2,407	-	-
4	2,821	726	-	-
5	9,695	1,961	-	-
6	-	-	-	-
7	-	-	-	-
8	-	-	-	-
9	-	-	-	-
	£ 29,197	£ 11,444	£ 2,538	£ 32

The curve in Figure III - 2 corresponds to Clawson's derived demand for visits to National Parks at various assumed fee structures. The total increased revenue

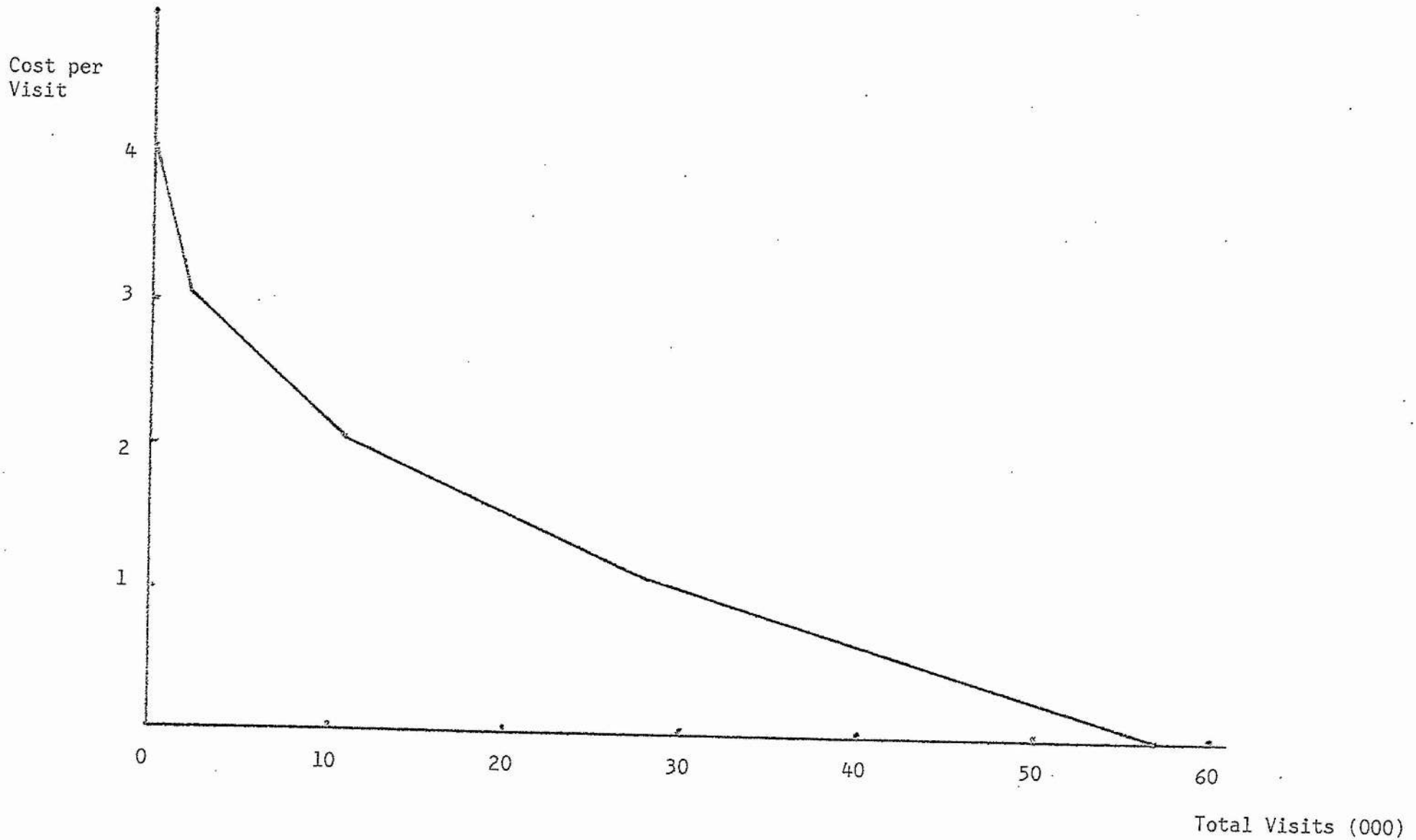


Figure III- 2 . The Clawson Derived Demand Curve for Loch Leven.

possible given these cost increases is as follows:

Added Cost	Projected Outings	Projected Revenue
£ 1	29,197	£ 29,197
2	11,444	28,888
3	2,538	7,614
4	32	128

These calculations represent the willingness to pay on the part of Loch Leven anglers.

According to these calculations, the maximum net economic value of Loch Leven was about £ 29,197 in 1978. This amount could be obtained by a private owner if he charged an added fee of £ 1 per outing. It then represents the amount of free benefits accrued to users of Loch Leven.

It should be noted that only a small increase in cost would be permitted by the anglers before they would stop coming to Loch Leven. The Y intercept of Figure III - 1 is approximately £ 11.85. Given the pattern of outings per 1000 population versus the cost per outing (see page 80) this is not surprising. At a cost of £ 15.08 per outing, only .69 visits per 1000 were recorded. A 97 percent increase in cost (from £ 7.66 to £ 15.08) resulted in a 844.3 percent decrease in visits--from 58.26 to .69 per 1000. In other words, demand elasticity is very high. Again, these benefit calculations assume that cost per visit

is the only factor affecting demand.

In order to compare the benefits to the costs calculated in Chapter II, it is necessary to calculate the Present Value of the £ 29.197. Two calculations will be made. The first for comparison with the least expensive cost figures[1] and the second for comparison with the highest cost figures.[2]

$$1) \quad PV = \sum_{t=1}^{12.47} \frac{29,197}{(1.15)^t} = £\,160,579$$

(Costs = £ 67,523)

$$2) \quad PV = \sum_{t=1}^{13.85} \frac{29,197}{(1.15)^t} = £\,166,555$$

(Costs = £ 94,700)

---

1 - Costs are equal to the cost of netting pike plus the cost of constructing and maintaining the fish farm system of unlined earth ponds and gravity-fed water.

2 - Costs are equal to the cost of netting pike plus the cost of constructing and maintaining the fish farm system of fibreglass tanks with pumped water.

3. Extensions to the Clawson Method

In Chapter I, Knetsch's proposed extensions to Clawson's model were discussed. It was Knetsch's feeling that the benefits of a resource cannot be properly valued if cost is assumed to be the only factor affecting the visitation rate. Hines, in his reply to the Trice and Wood article also criticized those who do not include factors other than cost in their calculations. He noted that "the great disadvantage to the "travel cost" index is that it achieves simplicity and measurability at the expense of significance and relevance".[1]

Knetsch suggested that instead of

$$V = f(c)$$

that

$$V = f(C,G,S,Y,T)$$

where: V = visits per unit of population

G = some measure of congestion

S = substitute areas available to the recreationist

Y = income

T = the opportunity cost of time

---

1 - Lawrence G. Hines. "Measurement of Recreation Benefits: A Reply". *Land Economics*. XXXLV. 1958. p. 366.

In order to apply other variables to the Clawson model, the original formula

$$Y = ae^{b_1 X_1}$$

may be extended to

$$Y = ae^{b_1 X_1 + b_2 X_2 + b_3 X_3 + \ldots + b_i X_i}$$

Knetsch's choice of variables will now be discussed and, where possible, applied to Loch Leven.

Income

Brown, Singh and Castle extended the Clawson model in their study of the salmon and steelhead sport fishery of Oregon. They divided the five main distance zones into thirty-five subzones based on income and distance. The net economic value of the sport fishery was calculated and it was found to be higher when income was included as a variable. Even though increases in daily cost were assumed as before, income did not change. The visitation rate was therefore not as sensitive to the cost increase and the effect of the increase was not as great.

The same technique could have been applied to the Loch Leven study had the anglers been asked to reveal their annual incomes. It was felt that the response to the questionnaire would not have been as good had income information been requested and therefore it was not. Any net economic value calculated will therefore be an underestimate of the real value.

Congestion

To include a measure of congestion in the model would require information, not only about congestion at Loch Leven, but at every other intervening opportunity as well. The response to the angler survey was 54% and had the response to a survey sent to managers of the various other resources been similar, the congestion calculations would have been very inaccurate. Also, since there are literally thousands of angling resources in Scotland, it was felt that congestion is not a factor which greatly affects demand.

One technique which may be employed to measure congestion would be to ask resource managers for the percentage of anglers to whom they had to refuse admission because of overcrowding. These percentages could then be compared to a similar percentage for Loch Leven in order to arrive at some congestion comparison.

Substitute Areas and The Opportunity Cost of Time

The problem of substitute areas is not as straightforward as it may initially appear. Loch Leven is a unique resource and, according to the Hon. Secretary of the Scottish National Angling Clubs Association, there is no other resource like it in Scotland. One may argue, therefore, that there exists zero substitution for Loch Leven. On the other hand, Scottish anglers do fish

elsewhere and the percentage of their total angling at Loch Leven is negatively correlated (-.62) with the distance that they must travel to Loch Leven.[1] Substitution is therefore a factor which must be taken into account.

In order to calculate the effect of the availability of substitute areas on the demand for Loch Leven, it was necessary to determine the location of the substitute areas. Three criteria were established for the definition of an intervening opportunity.

1) The resource must be a trout fishery.

2) It must be an inland resource.

3) The resource must be listed in the publication Scotland for Fishing.[2]

A weighted average distance to the nearest intervening opportunity from each town that hired a boat at Loch Leven in 1979 was calculated for each distance zone, and it was subtracted from the weighted average distance to Loch Leven. For example, the weighted average distance to Loch Leven from Zone 1 was 11.50 miles. The weighted average distance to the nearest substitute resource was 8.84 miles. The difference was 2.66 miles. This figure was

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1 - See Question 4 of the angler surveys.
2 - Scottish Tourist Board. Scotland for Fishing. Edinburgh, 1978.

then included in the formula

$$S^* = \frac{.2D^*}{2.33}$$

where: S^* = the cost of travelling the added distance to Loch Leven

D^* = the difference between the distance to Loch Leven and the distance to the nearest intervening opportunity (2.66 for Zone 1)

2.33 = the average number of passengers per automobile (calculated) through the angler survey

The term S^* may be defined as the opportunity cost to the angler of choosing Loch Leven instead of the nearest intervening opportunity to his home. In this way, both the effect of substitute areas and some measure of the opportunity cost of time are included in the calculations. It may be recalled from Chapter I that Knetsch regarded the opportunity cost of time as extremely important.

Calculations of D^* and S^* for the nine distance zones are as follows:

Zone Number	D^*	S^*
1	2.66	.23
2	10.61	.91
3	17.16	1.47
4	16.93	1.45
5	22.09	1.90
6	33.30	2.86
7	53.64	4.60
8	72.00	6.18
9	68.00	5.84

There are now two demand factors to be included in the calculations. The new formula is:

$$v = 3.94e^{-.0218c - .76s}$$

where: $v = V_i - \bar{V}$

V_i = the visitation rate per 100 population for each ith distance zone

$\bar{V}$ = 12.91 (unweighted average)

c = cash cost of travelling to Loch Leven

s = the opportunity cost of choosing Loch Leven instead of the nearest intervening opportunity.

As before, increased cash costs are assumed, and given these increased costs, the projected revenue may be calculated.

Added Cost	Projected Outings	Projected Revenue
£ 0	40,969	£ 0
1	40,586	40,586
2	12,051	24,102
3	2,180	6,540

Again, these values represent the willingness to pay on the part of the anglers.

The net economic value, or value of free benefits received, is £40,586. This is 59% higher than the value calculated when cost was the only variable affecting demand. This new calculation is still conservative since other factors, such as income, were not included. The Present

Value of £ 40,586 is calculated for comparison with the two cost figures found in Chapter II.

$$1) \quad \sum_{t=1}^{12.47} \frac{40,586}{(1.15)^t} = £\,223,216 \quad (\text{Costs} = £\,67,523)$$

$$2) \quad \sum_{t=1}^{13.85} \frac{40,586}{(1.15)^t} = £\,231,523 \quad (\text{Costs} = £\,94,700)$$

4. The Calculation of Primary Benefits Using Other Techniques

For purposes of comparison, several of the techniques used to evaluate user benefits discussed in Chapter I will now be applied to Loch Leven. The purpose of this exercise is to demonstrate how the use of different methods may yield vastly different amounts.

The Market Value Approach

In 1978, 13,336 trout were caught be anglers at Loch Leven and the total weight of these trout was 15,292 lbs. 14 oz.[1] The retail value of trout is approximately £ 1.10 per pound, so the total market value of the Loch Leven catch was £16,800 in 1978. Loch Leven anglers spent more than £ 248,000 in pursuit of £ 16,800 worth of fish or, in other words, each fish cost its captor almost £ 20.00. If we assume that catching fish is the primary objective (as we must if we are to accept the market value technique),

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1 - Source: Loch Leven Fisheries.

then we see that Loch Leven anglers employ an inefficient method of procuring their trout.

The Expenditure Approach

Using this technique, angler benefits were equal to £248,000 in 1978. Again, it must be noted that gross expenditures are not a measure of recreation benefits, but a measure of the cost of a basket of complementary goods that are necessary to enjoy the recreation experience.

The Pearse Approach

A variation of the Pearse approach may be applied to Loch Leven wherein anglers are divided into groups based on angling club affiliation rather than income. Homogeneity of income is assumed for each club. The highest cost per outing for each club will be calculated and the average cost for each club will be subtracted to yield an average consumers' surplus. The clubs listed below represent most areas of Scotland, so these average surplusses may be summed and then applied to the total population of Scottish anglers.

AVERAGE CONSUMERS' SURPLUS FOR EACH OF THE CLUBS SURVEYED

Angling Club	Number of Observations	Highest Cost per Outing Recorded	Average Consumers' Surplus
1	7	£ 13.82	£ 2.83
2	6	16.55	1.19
3	9	13.56	4.94
4	6	8.02	1.12
5	10	16.28	6.64
6	3	6.91	1.32
7	1	-	-
8	9	14.10	4.07
9	6	12.92	2.98
10	5	16.16	5.94
11	5	18.47	1.98
12	33	15.36	5.24
		Average (weighted)	£ 4.20

This weighted average consumers' surplus of £ 4.20 is multiplied by 27,477 (the total number of Scottish outings) to yield a primary benefit value of £ 115,000.

The Hotelling Approach

Following this technique, anglers from the furthest distance zone (Number 9) are assumed to break even, or enjoy no free value received. Anglers from the other eight zones are assumed to enjoy free value received equal to the difference between their transportation costs and those of Zone 9 anglers. The free value received for each zone is then multiplied by the total number of outings from that zone to yield total benefits. These benefits, when aggregated over all nine zones yield a primary benefit value. The calculations appear on the following page. It

will be seen that according to the Hotelling method, total primary benefits for 1978 are £165,849.

Zone Number	Average per Angler Cost for One Return Trip to Loch Leven	Free Value Received	Number of Outings	Total Benefits
1	.99	7.42	3,060	22,705
2	1.47	6.94	9.246	64,167
3	2.39	6.02	4,931	29,685
4	2.70	5.71	1,487	8,491
5	2.82	5.59	5,603	31,321
6	4.50	3.91	1,733	6,776
7	6.24	2.17	1,204	2,613
8	6.35	2.06	44	91
9	8.41	0	169	0
				£ 165,849

The Trice and Wood Approach

This technique requires the calculation of travel cost at the 90th percentile as well as at the median. The latter is subtracted from the former and resulting figure is multiplied by the total number of outings to yield a value for primary benefits received. For Loch Leven in 1978,

90th Percentile Value £ 3.21

Median Value - 1.74

£ 1.47

Total Benefits = 27,477 x £1.47

= £ 40,391.

It is evident that there are a wide range of benefit values obtainable. These are dependent on the measurement

technique used. Values for Loch Leven range from £ 16,800 using the Market Value approach to £ 248,000 using the Expenditure approach. Much depends on which technique the researcher feels is the most appropriate.

The extended Clawson approach deals with the problem of willingness to pay in a more scientific manner than do the others. It allows for the introduction of additional demand factors which the other techniques discussed in Chapters I and III do not. Any number of factors may affect the demand for a recreation resource for the value of benefits received from the use of that resource and using the Clawson technique, variables may be added or deleted depending on the nature of the resource under study. For these reasons and for the reasons discussed earlier, it is felt that the extended Clawson approach is the most appropriate for the case of Loch Leven.

CHAPTER IV

THE CALCULATION OF SECONDARY BENEFITS AND THE BENEFIT-COST RATIO

As discussed in the previous chapter, primary benefits are defined as those accrued to users of the resource. They may be expressed as the willingness to pay on the part of consumers. As Clawson points out, "these values may or may not register in the commerce of the nation, but this does not make tham any less real."[1] There is also a second class of benefit to be accrued from the existence of a recreation resource. These secondary benefits are realized by the population of the area where the consumer expenditures are made. They may be defined as the Regional Income Generated (RIG) by the existence of the resource.

Tourism and recreation are often regarded as good investments for a region since a steady influx of outsiders bring with them money to spend at or near the recreation site. Certainly many communities thrive on the spending of tourists and sportsmen and tourism is an important factor in the economic welfare of the Kinross area.

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1 - Marion Clawson and Jack Knetsch. *Economics of Outdoor Recreation.* Baltimore, 1966. p.231.

1. The Calculation of Secondary Benefits

In order to calculate the benefits accrued to a region as a result of the operation of a recreational facility, it is necessary to establish the spending patterns of the users of the facility. The survey questionnaire sent to 210 anglers questioned the respondents about spending amounts. No information was gathered about what percentage of this spending was done 1) at or near the users' homes, 2) en route to the recreation site (Loch Leven) and 3) at the site. It was felt that since the questionnaires were mailed up to one year after the time of use of the loch, the anglers would not be able to accurately respond to questions concerning expenditure patterns.

Marion Clawson and Jack Knetsch gathered together the results of some twenty-two surveys to establish the percentage of total spending accounted for by food, lodging, transportation and other expenditures.[1] They found that food accounted for 33.5 percent of total spending; lodging, 25.0 percent; transportation, 22.8 percent and other expenditures, 22.7 percent.

The data was broken down according to the type of resource. Four types are defined. They are:

1) National Parks -- Visitors to the U.S. National Parks were estimated to have spent, on average, $15.50 per

1 - Clawson and Knetsch. *op. cit.* p. 235.

trip of which roughly two-thirds was cash cost; the remainder a charge for the use of equipment, particularly the automobile.

2) State Parks -- The typical visit to a State Park is a one day affair requiring little expense for lodging, less for food since more meals will be eaten at home before or after the trip, and less for travel because of the shorter distance.

3) National Forests -- The pattern of expenditure for users of National Forest resources was found to be intermediate since trips to these resources are often longer than typical trips to State Parks yet shorter than excursions to National Parks.

4) Federal Reservoirs -- Federal Reservoirs are similar to State Parks except that at a Federal Reservoir, the cost of equipment (such as boats) is higher.

The breakdown of costs incurred by users of these different resources is given below.

ESTIMATED EXPENDITURE PER PERSON PER DAY FOR VISITORS TO SPECIFIED KINDS OF PUBLIC RECREATION AREAS 1960

Item of Expense	National Parks		State Parks		National Forests		Federal Reservoirs	
Food								
i) Restaurants	$2.00	12.9%	$1.00	12.5%	$1.75	12.9%	$1.00	10.3%
ii) Groceries	1.50	9.7	1.00	12.5	1.75	12.9	1.00	10.3
Lodging	2.70	17.4	.50	6.3	1.50	11.1	.50	5.1
Transportation	2.00	12.9	1.00	12.5	2.00	14.8	1.75	18.0
Other	1.80	11.6	.75	9.4	1.50	11.1	1.50	15.4
Charge for Use of Equipment								
i) Auto	4.00	25.8	2.50	31.3	3.50	26.0	2.50	25.6
ii) Other	1.50	9.7	1.00	12.5	1.50	11.1	2.00	20.5
Total	$15.50	100%	$9.50	100%	$8.00	100%	$9.75	100%

Source: Clawson and Knetsch. *op. cit.* p. 236.

According to the above definitions, Loch Leven seems to be most like an American Federal Reservoir. At Loch Leven, relatively little was spent on food and beverage, very little on lodging, a sizeable portion on transportation, and a large portion on the use of equipment, mainly boats. However, it is still not known what percentage of total expenditure was incurred by the anglers at home, en route and at or near the site.

Fortunately, Clawson and Knetsch provide estimates for this crucial set of data. The breakdown for Federal Reservoirs is presented below.

	Percentage Spent		
Item	In or near park	En route	In home community
Food			
i) Restaurants	65	35	0
ii) Groceries	10	5	85
Lodging	60	40	0
Transportation	25	15	60
Equipment	20	20	60
Other	50	15	35

Source: Clawson and Knetsch. *op. cit.* p. 237.

With some necessary manipulation, these data may be applied to Loch Leven to yield the cost breakdown estimates found on the following page.

BREAKDOWN OF EXPENDITURES BY OVERNIGHT VISITORS TO LOCH LEVEN

Item	Average Expenditure Per Outing	Percentage at Kinross	Total at Kinross
Boat Hire	£ 2.80	100%	£ 2.80
Food and Beverage			
i) Restaurants	3.55	65	2.31
ii) Groceries	3.54	10	.35
Equipment	1.61	20	.32
Hotel	9.32	100	9.32
Transportation	2.37	25	.59
Other	.24	50	.12
Total	£ 23.43		£ 16.40

BREAKDOWN OF EXPENDITURES BY DAY VISITORS TO LOCH LEVEN

Item	Average Expenditure Per Outing	Percentage at Kinross	Total at Kinross
Boat Hire	£ 2.80	100%	£ 2.80
Food and Beverage			
i) Restaurant	.93	65	.61
ii) Groceries	.94	10	.09
Equipment	1.61	20	.32
Transportation	2.37	25	.59
Other	.24	50	.12
Total	£ 8.89		£ 4.53

The amounts £ 16.40 and £ 4.53 represent that part of per outing expenditure made at Kinross by overnight visitors and day visitors respectively. The total amounts spent at Kinross are found by multiplying the total number of outings by these figures.

Total "Overnight" Expenditures at Kinross = 16.40 x 275	4,510
Total "Day" Expenditures at Kinross = 4.53 x 27202	123,000
Total Expenditures at Kinross	£ 127,510

Reference was made to the term Regional Income Generated or RIG earlier in this chapter. Certainly not all of the 127.510 spent at Kinross in 1978 can be considered as income generated in the area. Much of what is received by restaurants, groceries, petrol stations, pubs, equipment stores and hiring outlets and other enterprises must be directed toward the payment of taxes as well as distributors, breweries, farmers, wholesalers and other entities outside the Kinross area. Only a portion of what is spent in a region remains there to generate local income.

In 1974, a study was undertaken by the Tourism and Recreation Research Unit of the University of Edinburgh in the Greater Tayside Region of Scotland. Its aim was to measure quantitatively the regional impact of tourism. A formula for RIG was devised. It is

$$G_r = \sum_{j=1}^{J} \sum_{i=1}^{I} N_j \, Q_j \, K_{ji} \, Y_i \, \frac{1}{1 - L \sum_{i=1}^{I} X_i \, Z_i \, Y_i}$$

where G_r = Regional Income Generated

N_j = the number of days (or outings) spent in the region by the j th type of tourist

Q_j = the total daily expenditure by the j th type of tourist (or expenditure per outing)

K_{ji} = the proportion of £1 expenditure spent by the j th type of tourist in each i th type of business

L = the average propensity to consume from disposable income

X_i = the proportion of total consumer spending by residents in the i th type of business

Y_i = income generation per £1 of turnover by the i th type of business in the region

Z_i = the proportion of consumer spending by residents in the i th type of business within the region.

The terms N_j and Q_j together represent the multiplicand, while the remainder of the expression specifies the consequent multiplier process. The components N_j and Q_j were calculated earlier in this chapter and the term N_jQ_j is equal to £127,510 for Loch Leven in 1978. The above equation for RIG may now be simplified and presented in the following way.

$$RIG = £127{,}510 \; m$$

where m is the multiplier calculated in the Tayside Study.

In order to arrive at a set of numbers for this multiplier, the researchers defined several types of tourist. "The major distinction is between those tourists who stay overnight in a region and those who do not."[1] Non-resident visitors may be either day trippers or transit visitors--those who pass through a region but do not stay overnight. Those who do stay overnight may be classified according to type of accommodation--hotel, guesthouse, bed and breakfast, caravan, tent, chalet and accommodation by friends and relatives. The type of tourist is important since his accommodation affects his pattern of spending. It will be seen that noticeably different multipliers were calculated for each type.

Another factor to be considered is the type of activity being pursued at the resource in question. The Tayside Study examined five community and activity types and presented a representative example of each type. These were:

a) Nodal town -- Perth

b) Highland centre -- Pitlochry

c) Seaside town -- Arbroath

d) Rural area -- Around Loch Tay

e) Special activity centre -- St. Andrews (golf)

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1 - J.T. Coppock and Brian S. Duffield. *The Economic Impact of Tourism--A Case Study in Greater Tayside.* Edinburgh, 1974. p. 30.

Since the aim of the study was to establish what portion of each £ 1 spent in a community remained in that community to generate income, it was necessary to calculate where the remainder goes. The "tiered - region approach" was employed and it is illustrated diagramatically on the following page.

Interviews were conducted with 7,000 Scottish residents in their homes to establish their holiday-making patterns, while 11,500 visitors to Scotland were interviewed upon the completion of their trips. Information was also gathered from businesses with regard to revenue and expenses. Detailed information was gathered from 248 businesses about the following:

i) Profits

ii) Wages and Salaries

iii) Rents

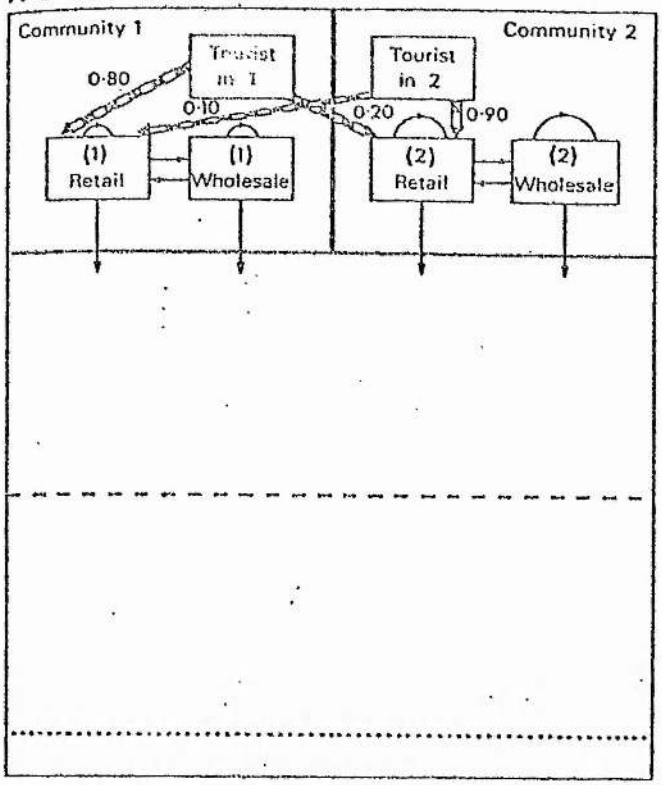
iv) Payments to other suppliers (retailers, wholesalers or manufacturers)

v) Payments to public utilities and local authorities

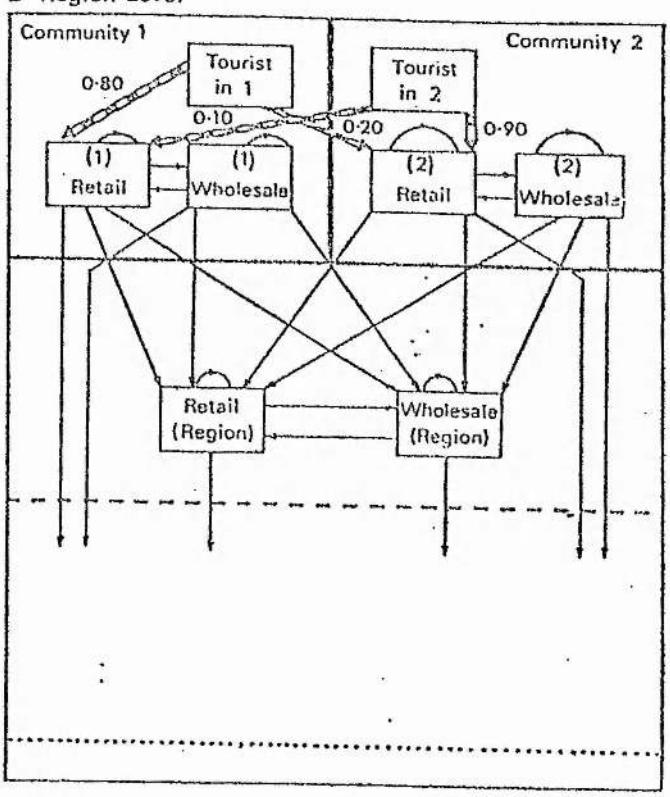
vi) Payments to and subsidies from the central government.

In 1978 a study was undertaken under the joint sponsorship of the Fife Regional Council, the North East Fife District Council and the Royal and Ancient Golf Club to estimate the economic impact of the 1978 British Open

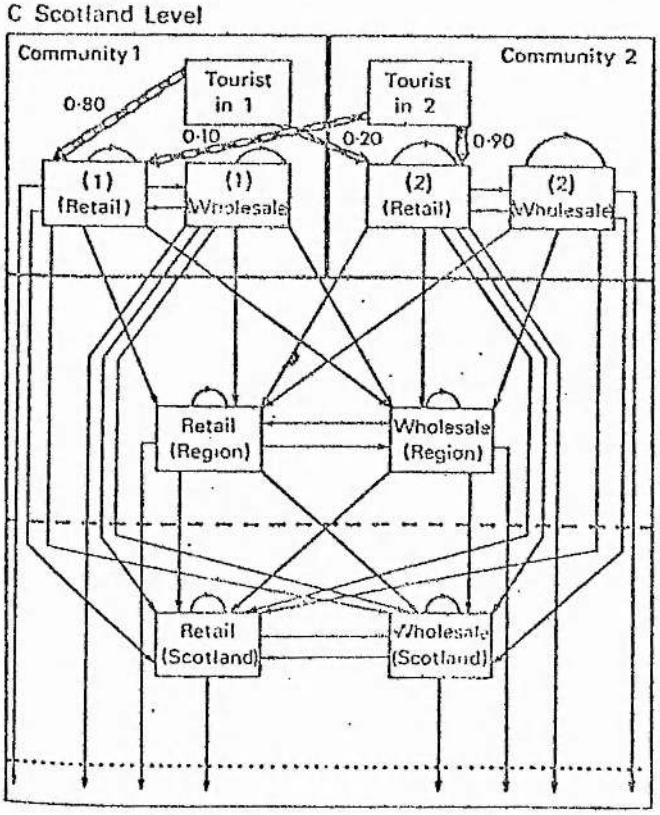
A Local Level



B Region Level



C Scotland Level



Community boundary

Tayside boundary

Scotland boundary

Tourist expenditure

Inter business transaction

Golf Championship held in St. Andrews. The specific objective of the study was described as an effort to "measure the impact of the 1978 Open Golf Championship on the local economy of St. Andrews and its surrounding district".[1] "Impact" was defined as "changes in local income and employment which can be shown to arise directly or indirectly from the Open Championship".[2]

Using four separate questionnaires, the research team set out to establish the pattern of spectators' expenditures, competitors' expenditures, expenditures by outside contractors and exhibitors and expenditures by outside employees and individual casual staff. A fifth questionnaire was distributed to businesses in the area to determine the magnitude of additional receipts and expenses that were realized as a direct result of the Open. The purpose of these questionnaires was to determine how much was spent in and around St. Andrews, and what portion of these expenditures remained in the area to generate local income. The five survey questionnaires may be found in Appendix 1.

The research team concluded that of the more than 3 million in additional expenditures, more than 1 million in extra income for the inhabitants of the North

1 - Christopher Blake, Stuart McDowall, Jennifer Devlen. *The 1978 Open Championship at St. Andrews--An Economic Impact Study*. Edinburgh, 1979. p. 4.

2 - *Ibid.*

East Fife District was realized.[1] This result was obtained using a set of multipliers similar to those calculated in the 1974 Tayside Study. In order to measure the impact of the Loch Leven Fishery on the Kinross area, these multipliers must be used.

Through the data obtained by the Tayside group's surveys, it was possible to calculate this multiplier component of the RIG formula. Two sets of multipliers are presented. The first, Table I may be found on the next page. The second, Table II may be found on the following page.

The numbers presented in Table I represent the amount, per £ 1 of expenditure, of income generated by each type of tourist in each of the three tiers described on page 105 and illustrated on page 106.

The multipliers in Table II represent the amount, per £ 1 of expenditure, of income generated by each type of overnight visitor in each type of centre (as defined earlier in this chapter). The multipliers in Table II cannot be applied to Loch Leven even though Kinross may be considered a Special Activity Centre, since no calculation was made for day visitors to a site. As indicated earlier, day visitors accounted for 99 percent of the total Scottish anglers who

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1 - Blake *et al. op. cit.* p. 31.

TABLE I

Income Multipliers -- Local, Regional and Scotland Levels
(by accommodation type and mode of travel)

Type of Tourist by Accommodation	Per Pound of Tourist Expenditure					
	Region			Local		
	Car	Train	Bus	Car	Train	Bus
Hotel	.299	.305	.319	.234*	.244	.239
Guesthouse	.340	.345	.378	.286	.284	.318
Bed & Breakfast	.518	.479	.530	.454	.417	.438
Touring Caravan	.277	-	-	.227	-	-
Static Caravan	.285	.273	.308	.225	.216	.232
Camping	.278	.263	.401	.228	.187	.302
Rented Accommodation	.355	.357	.358	.295	.292	.290
Friends & Relatives	.297	.283	.337	.246	.234	.267
Other	.293	.287	.335	.239*	.287	.265
Day Trippers	.312	.250	.246	.239	.197	.196
Transit Visitors	.261	.305	.361	.216	.243	.263
Weighted Average (All Resident Tourists)	.321	.309	.374	.263	.253	.297
Weighted Average (All Tourists)	.320	.305	.332	.262	.251	.262

	Scotland		
	Car	Train	Bus
Hotel	.450	.438	.486
Guesthouse	.471	.471	.514
Bed & Breakfast	.666	.615	.674
Touring Caravan	.403	-	-
Static Caravan	.513	.469	.534
Camping	.402	.333	.532
Rented Accommodation	.497	.498	.501
Friends & Relatives	.425	.390	.459
Other	.454	.469	.511
Transit Visitors	.371	.444	.512
Day Trippers	.477	.362	.381
Weighted Average (All Resident Tourists)	.466	.431	.514
Weighted Average (All Tourists)	.468	.426	.462

Source: Coppock and Duffield. *op. cit.* p. 40.

TABLE II

Income Multiplier -- By Type of Community, for Expenditure by Tourists in Accommodation Type of Overnight Stay

Intra-Community portion of tourist pound

Tourist Type by Accommodation	Special Activity Centre	Seaside Town	Highland Centre	Nodal Town	Rural Area
Hotel	.231	.193	.224	.248	.170
Guesthouse	.285	.324	.269	.310	.257
Bed & Breakfast	.498	.513	.382	.473	.428
Touring Caravan	.182	.202	.218	.219	.118
Static Caravan	.194	.206	.226	.217	.120
Tent	.182	.200	.220	.227	.118
Let Accommodation	.237	.250	.287	.240	.296
Friends and Relatives	.145	.166	.231	.247	.122
Average (All Resident Tourists)	.227	.226	.245	.274	.185

Source: Coppock and Duffield. *op. cit.* p. 40.

visited Loch Leven in 1978.

With reference to the first set of multipliers in Table I, numbers to be used in the calculation of the secondary benefits of Loch Leven are those for overnight visitors travelling by car and staying in a hotel, and day trippers travelling by car. We wish to calculate the impact of the Loch Leven Fishery on Kinross, so the "local" multipliers will be used. Expenditures by overnight visitors to Kinross will therefore be multiplied by .234 while expenditures by day trippers will be multiplied by .239.[1] Therefore:

$$RIG_{on} = £\,4510 \times .239 = £\,1078$$

where: RIG_{on} = the Regional Income Generated by the expenditures of Overnight Visitors to Loch Leven = 1078

£ 4510 = total expenditures by Overnight Visitors to Loch Leven in 1978 (the multiplicand)

.239 = the multiplier

and

$$RIG_{d} = £\,123{,}000 \times .234 = £\,28{,}782$$

where:

RIG_{d} = The Regional Income Generated by the expenditures of Day Visitors to Loch Leven in 1978 = 28,782.

---

1 - Please note that a weighted average for all visitors is included in Table I. This weighted average cannot be used since the ratio of day to overnight visitors to Loch Leven is substantially larger than the ratio of day to overnight visitors in the Tayside Study. To find the approximate weighting for the Tayside Study, please see Appendix 3.

£ 123,000 = total expenditure by Day Visitors to Loch Leven in 1978 (the multiplicand)

.234 = the multiplier.

In order to calculate the total Regional Income Generated or total secondary benefits for 1978, RIG_{on} and RIG_{d} are simply added together. The total amount is £ 29,860.

The Present Value of these secondary benefits under the two time periods calculated in Chapter II may now be calculated.

1) $$\sum_{t=1}^{12.47} \frac{29,860}{(1.15)^t} = £\ 164,225.$$

2) $$\sum_{t=1}^{13.85} \frac{29,860}{(1.15)^t} = £\ 170,337$$

2. The Benefit/Cost Ratio

In order to determine the economic viability of a project, a benefit/cost ratio must be calculated. If this ratio exceeds unity, then the project, from that point of view, is economically viable. The calculations below represent the ratio of the total Present Value of benefits accrued to both the users of Loch Leven and to the Kinross area, to the Present Value of the costs of netting pike and the costs of constructing and maintaining a fish farm. Two

ratios will be presented, based on the two sets of cost figures[1], for each of the techniques used to estimate the primary benefits.

1) The Market Value Approach

i) Present Value of Primary Benefits	£ 92,397
Present Value of Secondary Benefits	164,225
Present Value of Benefits	£ 256,622
Present Value of Costs	£ 67,523
Benefit/Cost Ratio	3.80
ii) Present Value of Primary Benefits	£ 95,836
Present Value of Secondary Benefits	170,337
Present Value of Benefits	£ 266,173
Present Value of Costs	£ 94,700
Benefit/Cost Ratio	2.81

1 - Cost figure (i) is the PV of the costs of netting pike plus the cost of a fish farm using unlined earth ponds and gravity-fed water.
2 - Cost figure (ii) is the PV of the costs of netting pike plus the cost of a fish farm using fibreglass tanks and pumped water.

2) The Expenditure Approach

i) Present Value of Primary Benefits	£	1,363,960
Present Value of Secondary Benefits		164,225
Present Value of Benefits	£	1,528,185
Present Value of Costs	£	67,523
Benefit/Cost Ratio		22.63
ii) Present Value of Primary Benefits	£	1,414,720
Present Value of Secondary Benefits		170,337
Present Value Of Benefits	£	1,585,057
Present Value of Costs	£	94,700
Benefit/Cost Ratio		16.74

3) The Pearse Approach

i) Present Value of Primary Benefits	£	632,482
Present Value of Secondary Benefits		164,225
Present Value of Benefits	£	796,707
Present Value of Costs	£	67,523
Benefit/Cost Ratio		11.80
ii) Present Value of Primary Benefits	£	656,019
Present Value of Secondary Benefits		170,337
Present Value of Benefits	£	826,355
Present Value of Costs	£	94,700
Benefit/Cost Ratio		8.73

4) The Hotelling Approach

i) Present Value of Primary Benefits	£ 912,142
Present Value of Secondary Benefits	164,225
Present Value of Benefits	£ 1,076,366
Present Value of Costs	£ 67,523
Benefit/Cost Ratio	15.94
ii) Present Value of Primary Benefits	£ 946,088
Present Value of Secondary Benefits	170,337
Present Value of Benefits	£ 1,116,425
Present Value of Costs	£ 94,700
Benefit/Cost Ratio	11.79

5) The Trice and Wood Approach

i) Present Value of Primary Benefits	£ 222,144
Present Value of Secondary Benefits	164,225
Present Value of Benefits	£ 386,369
Present Value of Costs	£ 67,523
Benefit/Cost Ratio	5.72
ii) Present Value of Primary Benefits	£ 230,411
Present Value of Secondary Benefits	170,337
Present Value of Benefits	£ 400,748
Present Value of Costs	£ 94,700
Benefit/Cost Ratio	4.23

6) The Clawson Approach

i) Present Value of Primary Benefits	£ 160,579
Present Value of Secondary Benefits	164,225
Present Value of Benefits	£ 324,804
Present Value of Costs	£ 67,523
Benefit/Cost Ratio	4.81
ii) Present Value of Primary Benefits	£ 166,555
Present Value of Secondary Benefits	170,337
Present Value of Benefits	£ 336,892
Present Value of Costs	£ 94,700
Benefit/Cost Ratio	3.56

7) The Extended Clawson Approach

i) Present Value of Primary Benefits	£ 223,216
Present Value of Secondary Benefits	164,225
Present Value Of Benefits	£ 387,441
Present Value of Costs	£ 67,523
Benefit/Cost Ratio	5.74
ii) Present Value of Primary Benefits	£ 231,523
Present Value of Secondary Benefits	170,337
Present Value of Benefits	£ 401,860
Present Value of Costs	£ 94,700
Benefit/Cost Ratio	4.24

If the most acceptable extended Clawson approach is used, the two benefit/cost ratios are 5.74 for system (i) and 4.24 for system (ii).

Conclusion

While many techniques for measuring primary benefits have been devised, very few may be considered worthy of application to actual recreation sites. The inadequate approaches discussed in Chapter I of this study often do not deal with the problem in a scientific manner. Many variables affect the value of a recreation resource, and for the most part, it would be impossible to include such variables in the calculations if some of these techniques were used. The Clawson approach allows for the introduction of new demand factors and for this reason, it is considered to be the most promising technique available.

The calculation of secondary benefits using the various income multipliers is logical and the technique may be applied universally. This author was fortunate since much of the work required to estimate the multipliers for Scotland had already been done by the Tayside researchers. Different multipliers would have to be estimated for different countries and this is an expensive and time-consuming, but necessary task. However, thanks to the Tayside researchers, a technique has been established which will facilitate future research in this field.

The benefit/cost ratios calculated in Chapter IV indicate that Loch Leven is a valuable resource and that anglers and businessmen benefit from its existence. The

benefits accrued exceed the cost of maintaining the loch as an outstanding resource and it is therefore recommended that measures be taken to ensure that those who benefit may be allowed to continue to do so.

Clearly Sir David Montgomery, the owner of the Loch Leven Fishery, should not be expected to bear the total cost of these improvements. The primary beneficiaries, the Scottish anglers, must be expected to contribute in some way, whether directly through an increase in fees, or indirectly through their government. The secondary beneficiaries must also contribute, again either directly, or indirectly through the local government authority. The percentage contributed by each group of beneficiaries should be equal to the percentage of the benefits accrued to that group.

The benefit calculations presented in this study are not without their flaws, and these flaws are acknowledged. One thing is clear however--Loch Leven is a very valuable asset and it must continue to exist as an outstanding angling resource.

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APPENDIX 1

46

1) How many members are in your family (residing at home)? .....

How many 1962 angling licenses (excluding one-day licenses) have been purchased by your family? .....

How many one-day angling licenses? .....

How many salmon-steelhead tags? .....

What was the total cost of these 1962 licenses for your family? ..... (Include only half the cost of co angler's and hunter's licenses.)

2) Please record below the expenditures made for equipment during the past 12 months because your family engages i We realize it will be necessary to charge only a part of certain costs to angling but we believe you can do this b we can.

EXAMPLE: *Assume you purchased a boat this past year and used it a total of 100 hours. Of this 100 hours, 50 h used for all angling of which 25 hours were for salmon and steelhead angling. In this case 50 percent should be al all angling and 25 percent should be allocated to salmon and steelhead fishing.*

For tackle, all of the cost is allocated to angling.

	Cost (only if purchased during past 12 months)	Percent of cost for past 12 months allocated to angling	Percent of co for past 12 mo allocated to salmon-steelhead a
Tackle			
Rod	.....	100	.....
Reel	.....	100	.....
Line	.....	100	.....
Creel	.....	100	.....
Tackle box	.....	100	.....
Landing net	.....	100	.....
Other tackle	.....	100	.....
Boating equipment			
Boats	.....	.....	.....
Boat trailer	.....	.....	.....
Outboard motor	.....	.....	.....
Other	.....	.....	.....
Special clothing			
Rubber boots	.....	.....	.....
Coats	.....	.....	.....
Rainwear	.....	.....	.....
Waders	.....	.....	.....
Other	.....	.....	.....
Camping equipment			
Tents	.....	.....	.....
House trailer	.....	.....	.....
Campers	.....	.....	.....
Sleeping bag	.....	.....	.....
Lantern	.....	.....	.....
Stove	.....	.....	.....
Other	.....	.....	.....
Other equipment expenditures not enumerated above			
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....

3) What was the approximate total yearly income of your family in 1961? (Check appropriate space.)

Under $3,000 ☐
$3,000- $5,000 ☐
$5,000- $7,000 ☐
$7,000-$10,000 ☐
$10,000-$15,000 ☐
$15,000-$20,000 ☐
Over $20,000 ☐

47

Did any member of your family fish in Oregon during June, 1962? Yes ☐ No ☐
If yes, please fill in the information below for days fished in Oregon.

June 1962	Give number of family members fishing each day for:			If fish were caught, how many?				Transportation on fishing trips			How much did you spend during June for:						
	Salmon	Steelhead	Other fish	Salmon	Steelhead	Jacks	Other fish	Mileage for your own car	Amount paid to you by others (not family)	Other transportation costs	Lodging	Food and beverage including liquor	Charter boats and guide service	Bait, lures and other tackle	Rental of: Boat and motor	Rental of: Tackle and gear	Other
Fri. 1																	
Sat. 2																	
Sun. 3																	
Mon. 4																	
Tue. 5																	
Wed. 6																	
Thu. 7																	
Fri. 8																	
Sat. 9																	
Sun. 10																	
Mon. 11																	
Tue. 12																	
Wed. 13																	
Thu. 14																	
Fri. 15																	
Sat. 16																	
Sun. 17																	
Mon. 18																	
Tue. 19																	
Wed. 20																	
Thu. 21																	
Fri. 22																	
Sat. 23																	
Sun. 24																	
Mon. 25																	
Tue. 26																	
Wed. 27																	
Thu. 28																	
Fri. 29																	
Sat. 30																	

APPENDIX I (a)

OPEN GOLF CHAMPIONSHIP : 1978

Spectator survey questionnaire

SECTION A (To be completed before interview)

1. Day (tick)

Mon	Tues	Wed	Thur	Fri	Sat
(1)	(2)	(3)	(4)	(5)	(6)

1

2. Times of day (tick)

10.00-12.00	12.00-14.00	14.00-16.00	after 16.00
(1)	(4)	(7)	(9)

2

3. Location (tick)

Stand			On Course	Tented Village	Practice Ground	Car Park
Comp	Res	Other				
(1)	(2)	(3)	(4)	(5)	(6)	(7)

3

SECTION B (to be completed after interview)

4. Kind of ticket (tick)

Daily	Season	Reserved	Composite
(1)	(4)	(7)	(9)

4

5. Sex (tick)

M		F	
(1)		(9)	

5

SECTION C/

SECTION C (Preamble)

"We are doing a survey of spectators on behalf of the Royal and Ancient, and I should be grateful if you could spare a few minutes to answer some questions.

"Have you been interviewed previously during this Championship?".

If 'Yes' end interview.

"Where is your permanent home?" .....

If local end interview.

SECTION D (to be completed during interview)

6. Are you staying away from home overnight because of the Open?

Yes		(1)
No		(9)

6 [ ]

(If 'No', go to Question 12).

7. Would you be here if the Open were not being held?

Yes		(1)
No		(9)

7 [ ]

8. What type of accommodation are you occupying during the Open?

	(tick)	
Hotel/Boarding House		(1)
Bed and breakfast		(2)
Self-catering house/flat		(3)
University residence		(4)
Caravan/Tent		(5)
Staying with friends/relatives		(6)
Other		(7)

8 [ ]

9. Where is that accommodation? ..... (Place)

	(tick)	
Town of St. Andrews		(1)
East of N.E. Fife District		(3)
Rest of Fife		(5)
Dundee/Angus/Perth		(7)
Elsewhere		(9)

10. How many nights will you be staying there?

	(tick)	
1 night		(1)
2 nights		(2)
3 nights		(3)
4 nights		(4)
5 nights		(5)
6 nights		(6)
7 nights		(7)
8 nights		(8)
more than 8 nights		(9)

11. What is the total cost per night of your accommodation?

	(tick)	
Less than £5		(1)
£5-£9.99		(2)
£10-£14.99		(3)
£15-£19.99		(4)
£20-£29.99		(5)
£30-£39.99		(6)
£40-£49.99		(7)
More than £50		(8)

Expenditure off the Golf Course (Preamble)

"Now I'd like to ask you a question about your expenditure off the Golf Course. I hope you will not mind providing this information, which will be extremely valuable to us.

"How much do you personally expect to have spent by the end of today outside the Golf Course, in:-

12. PURCHASES FROM SHOPS

	(tick)	
less than £1		(1)
£1 - £4.99		(2)
£5-£9.99		(3)
£10 - £14.99		(4)
£15 - £19.99		(5)
£20 - £24.99		(6)
£25 - £99.99		(7)
more than £100		(8)

12 ☐

13. GARAGE SERVICES (petrol, oil, etc.)

	(tick)	
less than £1		(1)
£1 - £4.99		(2)
£5 - £9.99		(3)
£10 - £14.99		(4)
£15 - £19.99		(5)
£20 - £24.99		(6)
£25 - £99.99		(7)
more than £100		(8)

13 ☐

14. RESTAURANTS/BARS

	(tick)	
less than £1		(1)
£1 - £4.99		(2)
£5 - £9.99		(3)
£10 - £14.99		(4)
£15 - £19.99		(5)
£20 - £24.99		(6)
£25 - £99.99		(7)
more than £100		(8)

14 ☐

15. OTHER ITEMS (e.g. entertainment, taxis, etc.)

	(tick)	
less than £1		(1)
£1 - £4.99		(2)
£5 - £9.99		(3)
£10 - £14.99		(4)
£15 - £19.99		(5)
£20 - £24.99		(6)
£25 - £99.99		(7)
more than £100		(8)

15 ☐

Off-Course Visitors

How many people came with you on your visit today who are not on the Golf Course?

16. Adults ☐ 16 ☐

17. Children ☐ 17 ☐

APPENDIX I (b)

1978 Open Golf Championship

Economic Survey

Competitors' Expenditure

Enter estimated total local expenditure of yourself and any dependents accompanying you. ONLY expenditure made in St. Andrews district should be entered.

		£
1.	Hotels/Boarding Houses	
2.	Private Households (Bed & breakfast, House Rentals, etc.)	
3.	Shops	
4.	Garages	
5.	Restaurants/Bars	
6.	Other payments	

APPENDIX I (c)

1978 Open Golf Championship

Economic Survey

Expenditure by Outside Contractors, Exhibitors, etc.

1. Name of Company:

2. Nature of Business:

3. Payments to Local* Businesses

		£
(a)	SHOPS	
(b)	GARAGES	
(c)	HOTELS	
(d)	RESTAURANTS/BARS	
(e)	OTHER PAYMENTS	

4. Payments to Local* Households

(a)	WAGES/SALARIES	
(b)	HOUSE RENTALS, BOARD & LODGING, ETC.	
(c)	OTHER PAYMENTS	

5. Total Number of Local* Inhabitants Employed

Signature: _____

Date:

APPENDIX I (d)

1978 Open Golf Championship
Economic Survey

Expenditure by Outside Employees and Individual Casual Staff

If LOCAL* Resident

Wages [ ]

1. Name of Company:

2. Job:

3. Payments to Local* Businesses

	£
(a) HOUSE RENTALS, BOARD & LODGING, ETC.	
(b) SHOPS	
(c) GARAGES	
(d) RESTAURANTS/BARS	
(e) OTHER PAYMENTS	

4. WAGES/SALARIES

* St. Andrews, Cupar and East Fife

APPENDIX I (c) 1978 Open Golf Championship Economic Survey

1. Nature of Business (please tick)

a) Shops
- Food [ ]
- Sports Goods & Clothing [ ]
- Clothing [ ]
- Other [ ]

b) Garages [ ]

c) Hotels & Guest Houses [ ]
Restaurants & Public Houses [ ]

d) Services
- Hairdressers, Cleaners etc [ ]
- Transport [ ]

e) Other [ ]

2. Did some or all of your regular staff (including yourself) work additional time during the 'Open' week?

[ ] Yes [ ] No

If yes, what were the total additional wages paid out to staff living:

a) in the St Andrews district* £_____

b) outside the St Andrews district £_____

3. Did you take on any extra staff during the 'Open' week?

[ ] Yes [ ] No

If yes, what was the total amount paid in wages to those living:

a) in the St Andrews district* £_____

b) outside the St Andrews district £_____

4. Many businesses may have had additional expenditure in preparation for, or as a direct result of the Open in the form of extra goods (food, drink etc.) or services (laundry, delivery etc.). If this applies to your business, please complete below:

a) additional goods

[ ] bought locally* expenditure £_____

[ ] bought outside the St Andrews district expenditure £_____

* St Andrews, Cupar & NE Fife

b) Additional services

☐ bought locally* expenditure £_____

☐ bought outside the St Andrews district expenditure £_____

In question 5 below we ask you to compare turnover during the week of the Open with turnover for the same week in earlier years. Obviously, price increases make direct comparison difficult. We therefore ask you to make the necessary adjustments to your turnover figures, allowing for these price increases and thus producing comparison in real terms.

5. Compared with your average turnover for the second week of July in the past three years, was your turnover for the 'Open' week

☐ greater approximate percentage increase ☐

☐ the same

☐ smaller approximate percentage decrease ☐

6. Compared with ONE week of this year's Glasgow holiday fortnight (July 16-29) was your turnover for the 'Open' week

☐ greater approximate percentage increase ☐

☐ the same

☐ smaller approximate percentage decrease ☐

Thank you for your help. If you have any comments you would like to make concerning the economic impact of the 1978 Open on St Andrews we would be pleased to receive them.

APPENDIX 2

UNIVERSITY OF ST. ANDREWS

DEANSCOURT,
ST. ANDREWS,
FIFE,
KY16 9QT.

March 10, 1979

Dear Sir,

I am a research student in the Department of Economics at the University of St. Andrews and I am attempting to measure the value of Loch Leven to the angling community. This is done by establishing how much anglers are willing to pay to use the loch.

In order to accomplish this, it is necessary to survey anglers who fished at Loch Leven in 1978. Would it be possible for you to either send to me the names of anglers who are members of your association, or distribute the anglers' questionnaires yourself?

If you are willing to participate in the survey, please complete the accompanying questionnaire and return it to me in the envelope provided.

Thank you very much.

Sincerely,

David Sloan.

Questionnaire

Association _____

1) Are you willing to participate in the survey as outlined in the accompanying letter?

Yes _____ No _____

If Yes, please answer the following questions.

2) How long did your club's 1978 visit to Loch Leven last? _____ day

_____ nig

3) Did members pay through the club for their trip to Loch Leven in 1978?

Yes _____ No _____

i) If Yes, what amount? £_____.

ii) Did this include:

Administration costs?	Yes _____	No _____
Transportation to and from Loch Leven?	Yes _____	No _____
Lodging?	Yes _____	No _____
Meals?	Yes _____	No _____
Boat hire?	Yes _____	No _____
Equipment hire?	Yes _____	No _____

4) What costs are <u>not</u> paid through the club? (That is, what do the members pay for independently?) Please tick

Transportation to and from Loch Leven	_____
Lodging	_____
Meals	_____
Boat hire	_____
Equipment purchase/hire	_____

5) Would you prefer to:

i) Send the names and addresses of members of your associatio to me?

Yes _____ No _____

ii) Distribute the questionnaires yourself? Yes _____ No _____

If Yes, please indicate; By post _____

In person _____

6) Would you like a copy of the results of my reasearch?

Yes _____ No _____

UNIVERSITY OF ST. ANDREWS

DEANSCOURT,
ST. ANDREWS,
FIFE,
KY16 9QT.

Dear Sir,

Thank you for returning my questionnaire and for expressing your willingness to participate in the survey. Here are the questionnaires that I would like distributed to your members. Each member will receive a questionnaire along with a covering letter and a stamped, addressed return envelope so that he or she can return the completed sheets to me as soon as possible. If you or your members have any questions, please let me know.

Thank you again for your cooperation. I will send you a copy of the results of my research as soon as the work is completed.

Yours truly,

David Sloan

UNIVERSITY OF ST. ANDREWS

DEANSCOURT,
ST. ANDREWS,
FIFE,
KY16 9

March 23, 1979

Dear Sir,

This is just a note to remind you of the questionnaire that I mailed to you on March 10. There has been some concern voiced about the inten of my research by angling clubs that have already responded to the questionnaire. Let me assure you that I am a student working towards a degree at th University of St. Andrews and the sole purpose of this research is to estimate the value of Loch Leven to the angling community. One way to do this is to establish what anglers are willing to pay to use the loch. To do this, I need your help.

If you have already mailed the questionnaire to me, please disregard this reminder. I look forward to hearing from you soon.

Yours truly,

David Sloan

P.S. If names are not available as requested, please provide as many as possible. Also, if you have lost the questionnaire, please let me know. I will be happy to send another one to you.

UNIVERSITY OF ST. ANDREWS

DEANSCOURT,
ST. ANDREWS,
FIFE,
KY16 9QT.

Dear Angler,

The accompanying questionnaire is being distributed by your Angling Club on my behalf. I am a research student in the Department of Economics at the University of St. Andrews and I am attempting to measure the value of Loch Leven to the angling community. This is done by establishing how much anglers are willing to pay to use the loch. I am asking you to please complete the questionnaire as accurately as possible and return it to me in the envelope provided.

Your Angling Club will be receiving a copy of the results of my research as soon as the work is completed and you are welcome to study these results. Thank you very much for your cooperation.

Yours truly,

David Sloan

QUESTIONNAIRE FOR DAY VISITORS TO LOCH LEVEN

PLEASE LEAVE THIS SECTION BLANK

Fee _____

Tr.C. _____

F & B C. _____

O.C. _____

T.C.E. _____ * Vis. _____

T.D.E. _____ * Cu. D____ E___

T.E. _____ ** Dis. _____

Club _____

1) How many times did you go to Loch Leven in 1978?

_____times.

2) In total, how many times did you go out on to the Loch to fish in 1978

_____day outings

_____evening outings

3) On average, how many people were in your boat, including you? (circle)

1 2 3

4) What percentage of your total angling for 1978 was done at Loch Leven?

_____%

5) Transportation

Were transportation costs included in the fee paid to your club for your 1978 trip to Loch Leven?

Yes _____ No _____

If you answered Yes, please skip to question 6. If you answered N please complete the following table.

Type of transportation	Number of Times Used	Return Fare for each Trip
Bus		£
Train		£

	Number of Times Used	Average number of people in car (including you)
Car		

6) Food and Beverage

On average, how much did you spend on food and beverage for each trip to Loch Leven in 1978?

£_____

7) Equipment

Please list the cost of all angling equipment bought by you or for you in 1978.

Tackle £_____ Other Equipment £_____

Special Clothing £_____

8) Please list any other expenses not enumerated in questions 5, 6 and 7.

Type	Amount
_____	£_____
_____	£_____

QUESTIONNAIRE FOR OVERNIGHT VISITORS TO LOCH LEVEN

PLEASE LEAVE THIS SECTION BLANK

Fee	_____			
Tr.C	_____			
F & B.C.	_____			
Acc.C.	_____		Days	_____
O.C.	_____		Nts.	_____
T.C.E.	_____	*	Out.	D_____ E_____
T.D.E.	_____	*	Accom.	_____
T.E.	_____	**	Dis.	_____

Club _____

1) How long did your 1978 trip to Loch Leven last?

_____days _____nights

2) In total, how many times did you go out on to the Loch to fish?

_____day outings

_____evening outings

3) On average, how many people were in your boat, including you? (circl

1 2 3

4) What percentage of your total angling for 1978 was done at Loch Leve

_____%

5) Transportation

Were transportation costs included in the fee paid to your club for your 1978 trip to Loch Leven?

Yes _____ No _____

If you answered Yes, please skip to question 6. If you answered please complete the following table.

Type of transportation	Number of Times Used	Return Fare for each Trip
Bus		£
Train		£

	Number of Times Used	Average number of people car (including you)
Car		

6) Food and Beverage

On average, how much did you spend on food and beverage for each day spent at Loch Leven in 1978?

£ _____

7) Equipment

Please list the cost of all angling equipment bought by you or for you in 1978.

Tackle £_____ Other Equipment £_____

Special Clothing £_____

8) Lodging

Were lodging costs included in the fee paid to your club for your 1978 trip to Loch Leven?

Yes _____ No _____

If you answered Yes, please skip to question 9 . If you answered No please complete the following table.

Type of Accomodation Used	Number of Nights Spent in Each Type	Cost per Nigh
Hotel		
Guesthouse		
Bed & Breakfast		
Camping		
Rented Accomodation (cottages		
Friends & Relatives		
Other (please specify)		

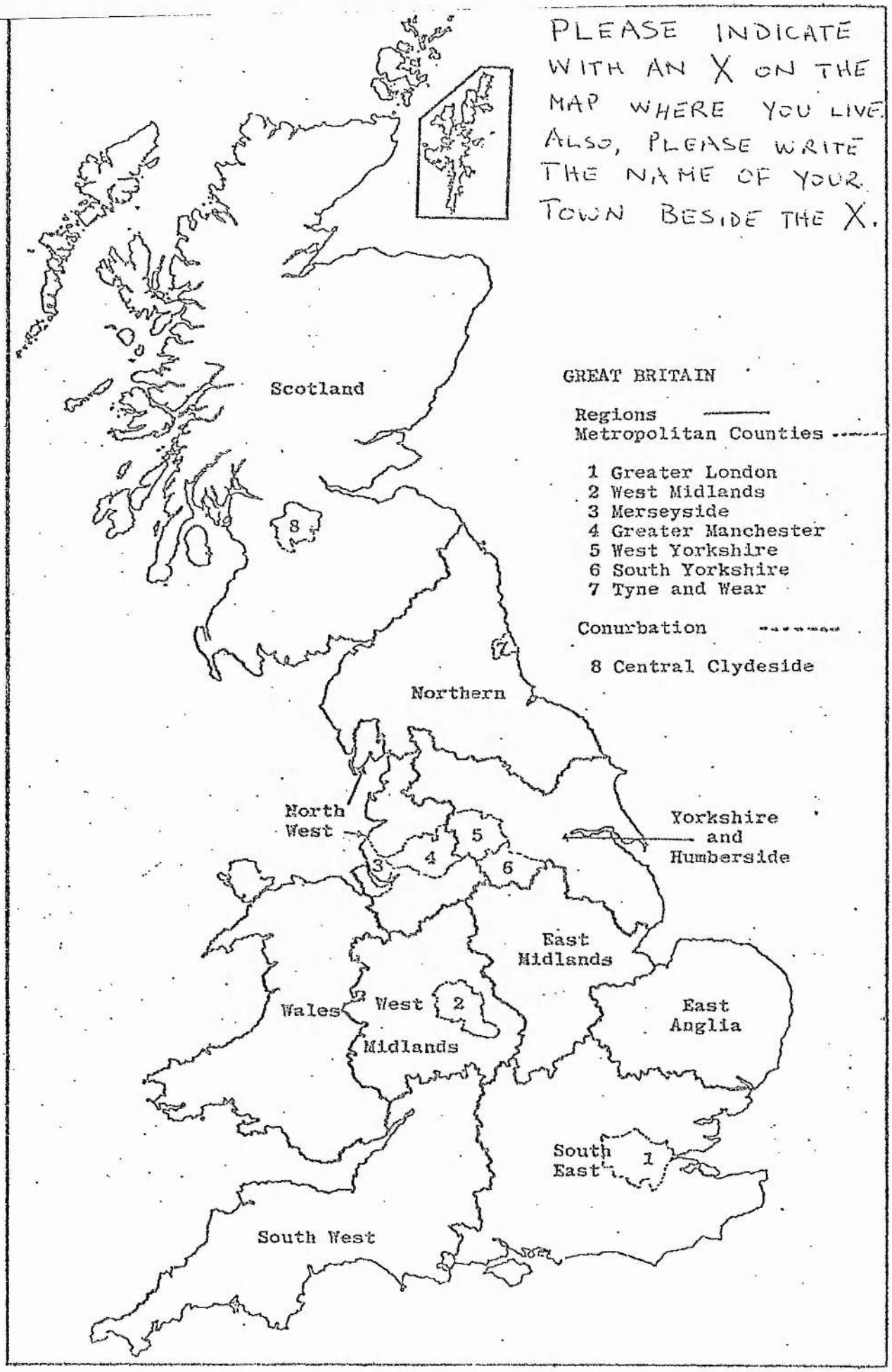
9) Please list any other expenses not enumerated in questions 5,6,7 and 8 above.

Type	Amount
_____	_____
_____	_____
_____	_____

PLEASE INDICATE WITH AN X. WHERE YOU LIVE. ALSO, PLEASE WRITE THE NAME OF YOUR TOWN BESIDE THE X.

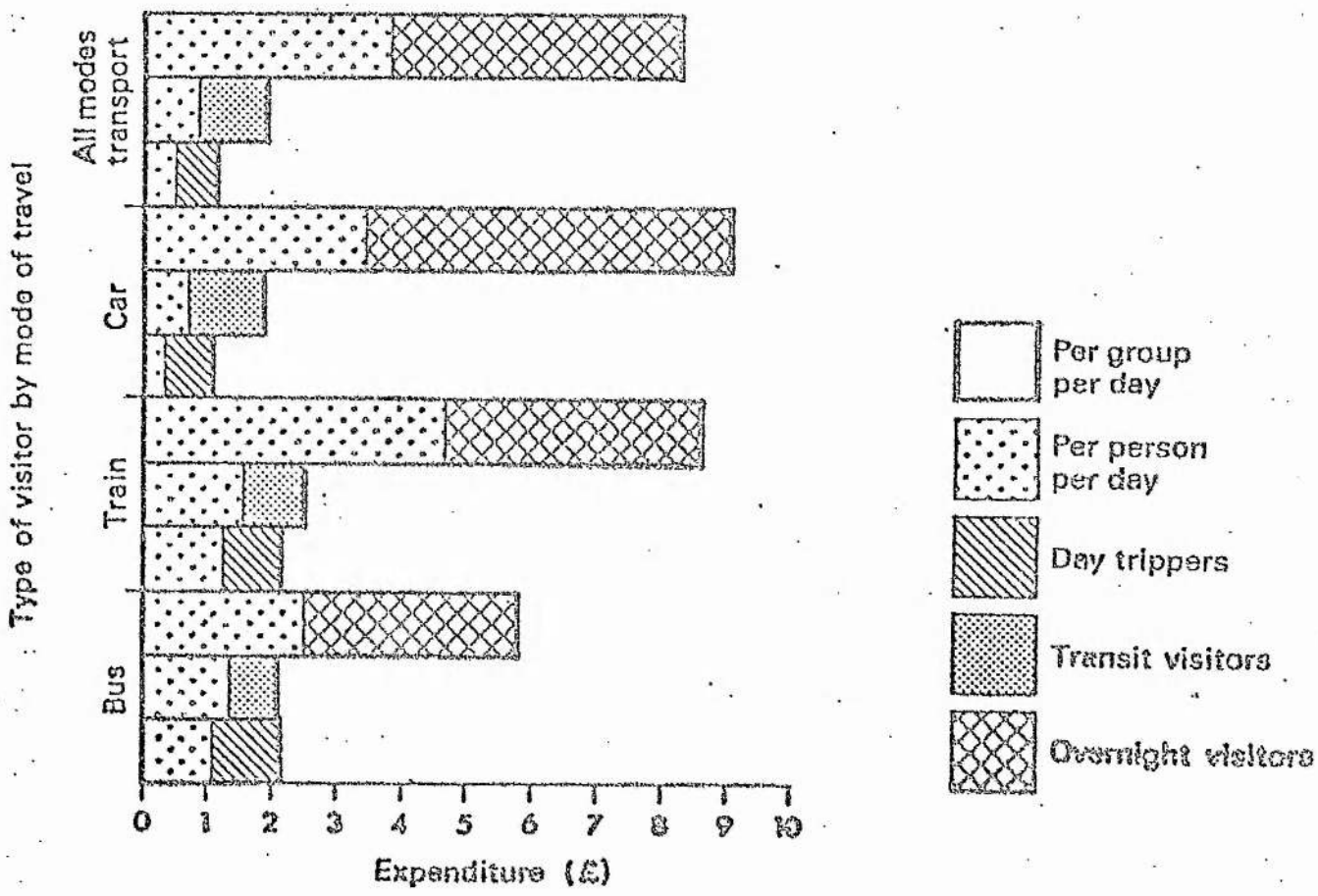
Produced by General Register Office, Scotland, January 1975

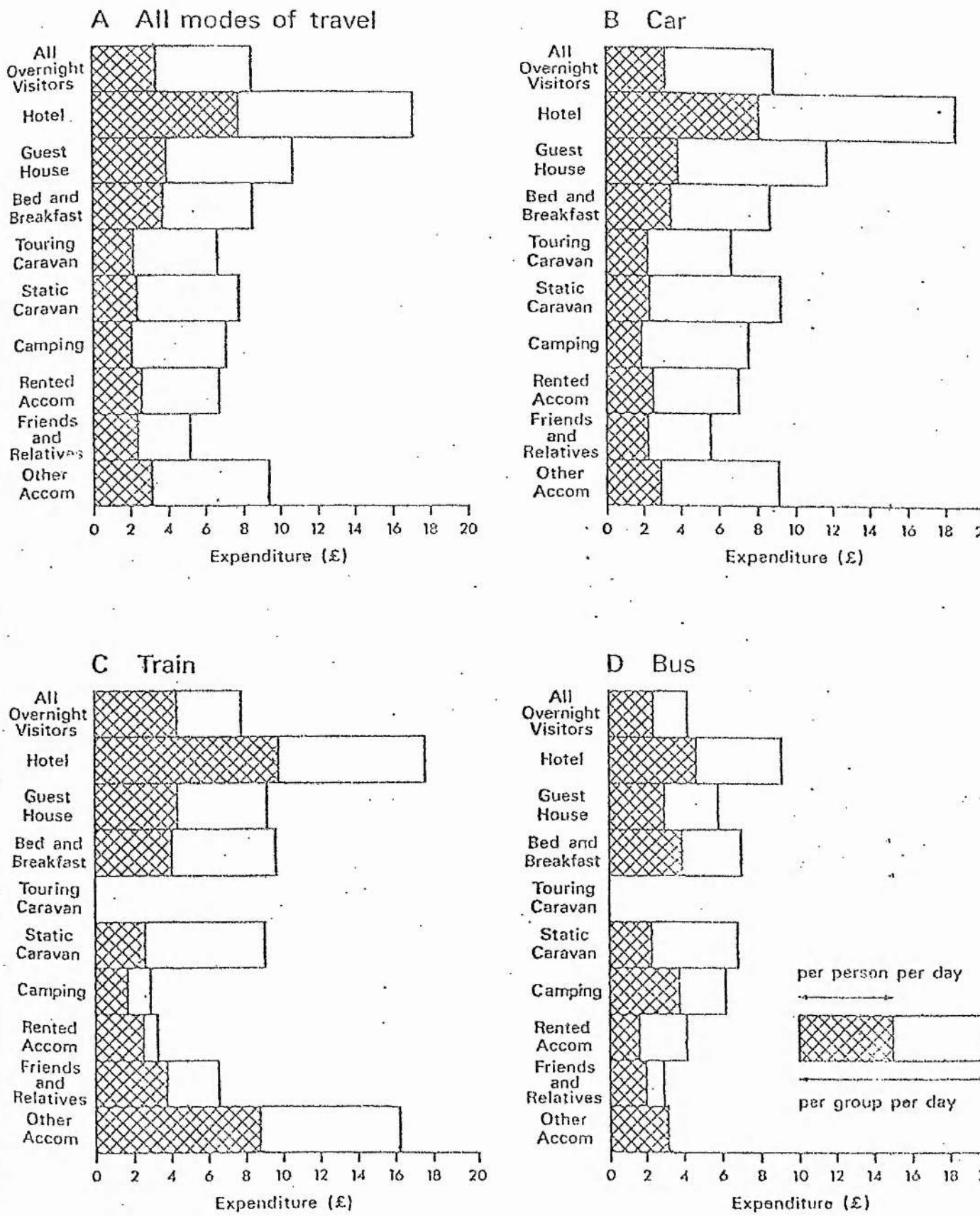
PLEASE INDICATE WITH AN X ON THE MAP WHERE YOU LIVE. ALSO, PLEASE WRITE THE NAME OF YOUR TOWN BESIDE THE X.



APPENDIX 3

: Average Total Expenditure for All Tourists (by mode of travel)




A All modes of travel
All Overnight Visitors
Hotel
Guest House
Bed and Breakfast
Touring Caravan
Static Caravan
Camping
Rented Accom
Friends and Relatives
Other Accom
0 2 4 6 8 10 12 14 16 18 20
Expenditure (£)
B Car
All Overnight Visitors
Hotel
Guest House
Bed and Breakfast
Touring Caravan
Static Caravan
Camping
Rented Accom
Friends and Relatives
Other Accom
0 2 4 6 8 10 12 14 16 18
Expenditure (£)
C Train
All Overnight Visitors
Hotel
Guest House
Bed and Breakfast
Touring Caravan
Static Caravan
Camping
Rented Accom
Friends and Relatives
Other Accom
0 2 4 6 8 10 12 14 16 18 20
Expenditure (£)
D Bus
All Overnight Visitors
Hotel
Guest House
Bed and Breakfast
Touring Caravan
Static Caravan
Camping
Rented Accom
Friends and Relatives
Other Accom
per person per day
per group per day
0 2 4 6 8 10 12 14 16 18
Expenditure (£)

: Tourist Expenditure - Average Daily Totals By Community Type of Overnight Stay